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ABSTRACT

This report describes an analytic training Device Effectiveness Forecasting Technique known as DEFT. DEFT accounts for device effectivness in terms of several different criteria and classes of independent predictor variables. In its present form, DEFT is a series of interactive, menu-driven computer programs that provide for three levels of device evaluation. The level of analysis is chosen as a function of the type of input data that are available and the degree of diagnosticity that is needed. The report includes a DEFT User's Manual and listings of DEFT programs. (Author)

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Research Product 85-25

Forecasting Device Effectiveness:
Volume II. Procedures

Training and Simulation Technical Area
Training Research Laboratory

June 1985

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This report describes an analytic training Device Effectiveness Forecasting Technique known as DEFT. DEFT accounts for device effectiveness in terms of several different criteria and classes of independent predictor variables. In its present form, DEFT is a series of interactive, menu-driven computer programs that provide for three levels of device evaluation. The level of analysis is chosen as a function of the type of input data that are available and the degree of diagnosticity that is needed. The report includes a DEFT User's Manual and listings of DEFT programs.

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Research Product 85-25

Forecasting Device Effectiveness:
Volume II. Procedures

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Training and Simulation

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Army training developers need tools to aid in the design, acquisition, and use of simulation- and computer-based programs of instruction for weapon operation and maintenance. One critical need is a job aid for the design and evaluation of training devices during all stages in the weapon acquisition cycle.

This series of three reports describes one approach to such aiding--a hybrid of decision analysis and mathematical modeling. The approach provides numerical estimates of device effectiveness which are based on expert ratings of trainee and task characteristics, functional and physical similarity between the proposed device and the operational equipment, and the instructional characteristics of the device. It is an analytic, computer-based technique--a menu-driven system--which can be used at any stage of training device design.

The product of this research can help training device procurers such as PM-TRADE and training developers in TRADOC make better documented decisions about training device design.

Edgar M. Johnson

EDGAR M. JOHNSON
Technical Director

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Many individuals have contributed directly and indirectly to the articulation of DEFT. In this regard, we wish to acknowledge the contributions of many staff, both past and present, of the Simulation Systems Design Team at the U.S. Army Research Institute. We especially wish to thank Dr. John A. Boldovici, the Project Monitor, for his assistance.

The final form of DEFT stems in large measure from the concepts of Dr. Daniel Tufano, formerly of ARI. His notion of a simple, higher-level forecasting procedure known as "Ben" gave rise to the three-tiered approach contained in DEFT. We wish to thank Dr. Tufano for his contributions and support.

Finally, we owe a deep debt of gratitude to Mr. Tim O'Connor of the American Institutes for Research. Tim did all of the programming required to bring DEFT to life. We wish to acknowledge Tim s exceptional programming skills and to thank him for the good-natured way in which he responded to our interminable modifications of concepts and procedures.

Forecasting Device Effectiveness: II. Procedures

EXECUTIVE SUMMARY

Requirement:

To specify measurement operations and procedures for a training device effectiveness forecasting technique; to develop a computerized version of the forecasting procedures and guidelines for their application.

Procedure:

A "deficit" model of device effectiveness was developed and four criterion constructs of device effectiveness were specified. The constructs vary as a function of five classes of predictor variables. These variables were converted to rating scales to generate estimates of device effectiveness.

Findings:

A device effectiveness forecasting technique known as DEFT was developed. DEFT consists of a series of interactive menu-driven computer programs that a device designer can use to evaluate alternative designs. DEFT permits evaluation at three different levels of detail depending upon availability of predictor information and degree of diagnosticity wanted. Each version of DEFT produces seven summary indexes of effectiveness.

Utilization of Findings:

Although not empirically validated, the forecasts provided by DEFT are of potential value during the device acquisition process when opportunities to conduct empirical research and evaluation are severely limited. DEFT provides a systematic procedure for developing and evaluating alternative training concepts. DEFT can be used to analytically examine the impact of specific design changes on different effectiveness criteria in lieu of or in addition to empirical evaluation.

FORECASTING DEVICE EFFECTIVENESS: II. PROCEDURES

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1. Overview

This report is submitted in partial fulfillment of Contract MDA 903-82-C-0414 between the Army Research Institute (ARI) and the American Institutes for Research (AIR). It is part of a programmatic effort to develop and analytically evaluate a model designed to forecast training device effectiveness. In this, the second report in a series, we describe a device effectiveness forecasting technique known as DEFT and present detailed descriptions of each of the several analyses contained in DEFT.

DEFT is a series of interactive, menu-driven computer programs that guide an analyst through the evaluation of a training-device-based training system. There are several computer programs in all that support the building and maintenance of data files and the conduct of analyses. Each is written in COBOL and is designed for use on an IBM PC equipped with a dual disk drive. Simple instructions in how to use DEFT are provided in Appendix A, the DEFT User's Manual. Listings of the various programs are contained in Appendix B.

DEFT converts information about various facets of the training system into forecasts of device effectiveness. A DEFT evaluation can be conducted at three different levels of analysis. The level that is chosen depends upon the types and amounts of information available to analysts and upon the degree of diagnosticity that is desired. If analysts have very detailed information about the training systems (e.g., descriptions of subtasks, displays, controls, instructional features, information about the trainee population, etc.) and want a highly diagnostic evaluation, they would choose the most detailed analysis -- DEFT III. If they have somewhat less detailed information consisting of general task descriptions and the like, and want a less diagnostic evaluation, they might opt for an intermediate level of evaluation -- DEFT II. Finally, if they have only very general information about the components of the training system and are interested only in a rather global evaluation, they might choose the least detailed version -- DEFT I.

Regardless of the level of DEFT that is chosen for the evaluation, the analyst conducts four major analyses. First is an analysis of the training problem to define the deficiency in skills and knowledge that trainees have relative to criterion performance on the training device.

As part of the same analysis, the analyst estimates the difficulty trainees would have in overcoming identified deficits. Second, the analyst examines the quality of training provided by the training device. During the acquisition efficiency analysis, the analyst determines which instructional features and training principles have been incorporated in the device to help trainees overcome their deficits. The training problem and training efficiency analyses comprise the acquisition component of DEFT.

The third and fourth analyses are analogs of the first two. In the third, the analyst undertakes an assessment of the transfer problem to assess the deficiency in operational criterion performance that remains after trainees have practiced on the device, satisfied the device proficiency criterion, and "graduated" from it. The analyst also determines how difficult it will be to overcome these residual deficits. Fourth and finally, the analyst conducts a transfer efficiency analysis. The analyst determines how well use of the training device will promote transfer of the learning that has occurred to the parent or actual equipment. The transfer problem and transfer efficiency analyses comprise the transfer component of DEFT.

The relationships between the acquisition and transfer components of the evaluation framework are shown in Figure 1. The figure also indicates that each major analysis is an integral part of DEFT, regardless of the level of evaluation (i.e., DEFT I, II, or III) that is chosen.

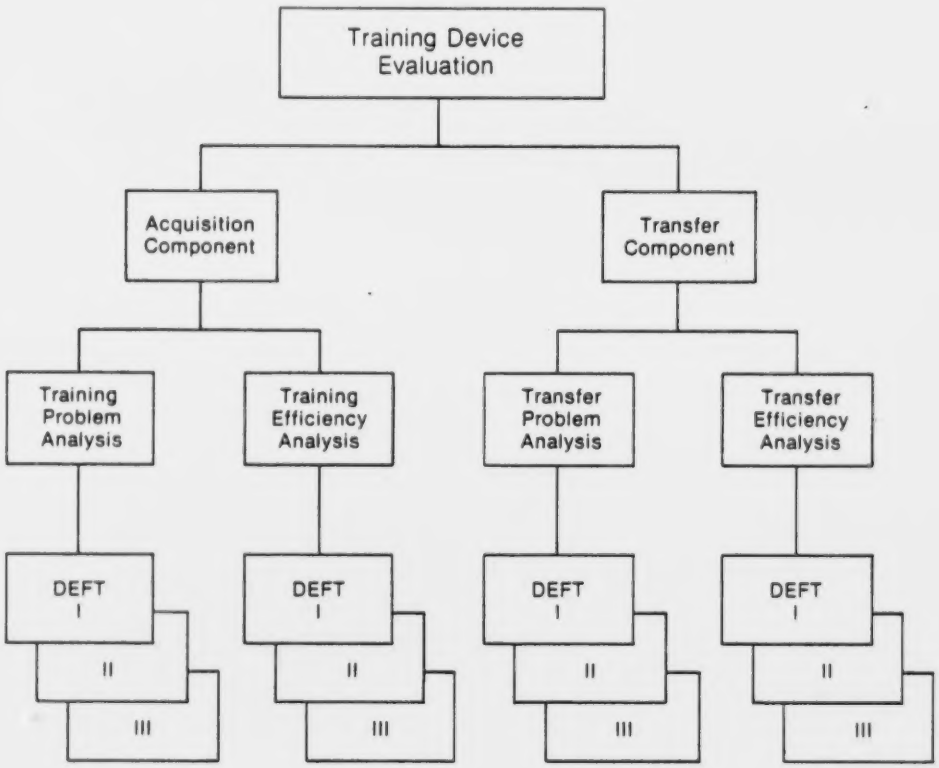

Figure 1. DEFT: Types and levels of analysis.

Once a particular level of evaluation is selected, it is carried out for all four analyses.[1] The general procedure is for the analyst to provide a number of judgments or estimates in response to a variety of rating scales that direct the analyst to consider different types of information about the training system and its parent equipment. Within each major type of analysis, the number and kind of ratings that are required vary as a function of how detailed available information is and how diagnostic the analyst wants to be. DEFT I requires eight ratings based on general information about the device and parent equipment. DEFT II entails 13 kinds of ratings, some of these being provided for each training or operational task under consideration. DEFT III requires 35 different types of ratings, many of these being provided for each training or operational subtask. Ratings are entered on a computer keyboard. The sequence in which ratings are completed is determined by the DEFT menus.

At the end of the evaluation exercise, the analyst receives numerical estimates of device effectiveness and diagnostic information on what the potential strengths and

---

[1]It may prove possible to mix levels of DEFT across types of analysis. However, the research needed to support such a finding remains to be done.

weaknesses of the device may be. Table 1 shows an example of an Evaluation Summary screen that may be requested and printed out. (The interpretations of these indexes will be discussed in Chapter 6.) Armed with this type of output,

Table 1

Evaluation Summary

Training Problem	**22.50**	
Acquisition-Efficiency	**.80**	
Acquisition		**28.13**
Transfer Problem	**27.50**	
Transfer-Efficiency	**.47**	
Transfer		**58.51**
Total Effectiveness		**86.64**

the analyst can then go back into the DEFT analyses, make different assumptions about the training system, enter revised ratings on selected scales and again call for the Evaluation Summary to determine the impact these "what if" changes have had on estimates of device effectiveness.

In the following chapters, we describe the four analyses constituting each of the three levels of DEFT. We also indicate in the final chapter how the individual ratings are aggregated to form more summary indexes and how the latter are to be integrated.

2. Training Problem Analysis

The first of the two analyses underlying the acquisition component of device evaluation is the training problem (TP) analysis. TP represents an estimate of two facets of the performance deficit that trainees bring to the training device: its magnitude and the difficulty that trainees will have in overcoming it.

The magnitude of the performance deficit is defined by considering two end points. The first is the level and type of proficiency associated with an explicit statement of the training-device-mediated training objective. For example, in a burst-on-target tank gunnery trainer, the objective might be to "secure second round main gun hits on nine out of ten simulated moving tank targets, within ten seconds of engaging each target, by applying burst on target techniques to adjust fire." Other objectives might require a different level of proficiency with respect to speed or accuracy or a different method of adjusting fire. The second end point is the typical trainee's level of proficiency, skills, and knowledge relative to the stated training objective prior to using the training device. For

example, trainees might be 19E Advanced Individual Training (AIT) graduates who have served as drivers and loaders in an armor unit for at least 18 months, but who have not served as gunners. Alternatively, they might be enlistees who have just finished Basic Combat Training (BCT) and on the basis of a particular Armed Services Vocational Aptitude Battery (ASVAB) profile, have just been assigned to 19E AIT where they will receive instruction in tank gunnery. With respect to the stated objective, the latter trainees would presumably have a larger performance deficit than the former trainees.

Once the analyst has quantified the nature and magnitude of the deficit, the next consideration is how difficult it will be for trainees, given their starting point, to acquire the kind and level of proficiency that is indicated in the training objective. The assessment focuses on the difficulty of acquiring required skills and knowledge as a function of selected characteristics of different kinds of tasks.[2]

---

[2]Standard task analysis procedures are used to identify the tasks in question, by decomposing the training objective into its constituent behavioral components. Such task descriptions are generated prior to using DEFT and, when available, are important input to the various analyses described in this report.

Performance deficit and learning difficulty combine multiplicatively to define the training problem. In other words, a relatively small deficit which is relatively hard to overcome represents the same problem or challenge to the training developer as a larger deficit which can be dealt with more readily. We turn now to the ways in which analysis of the training problem is conducted at each level of DEFT.

DEFT I. At this most global and least diagnostic level of DEFT, analysts estimate the magnitude of the training problem in terms of two rating scales. First, they rate the performance deficit aspect. Second, they rate the learning difficulty aspect.

To assist analysts in rating the magnitude of the performance deficit, DEFT I instructs them as follows:

> Examine the statement of the training objective(s). Considering what you know about the typical trainee's background, work experience, and prior training, what proportion of the skills and knowledges required in order to meet the training objective(s) will the trainee still have to learn in order to reach criterion proficiency in the training device?
>
> Enter a number from 0 to 100 using the following scale:
>
> F MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMS
> 0 10 20 30 40 50 60 70 80 90 100
>
> 0 = None; the trainee can already meet the training objective(s).
>
> 100 = All; the trainee has to learn all of the skills and knowledges needed to meet the training objective(s).

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To assist them in rating the magnitude of the learning difficulty for deficits they have identified, DEFT I instructs analysts as follows:

> Consider the enabling skills and knowledges required to meet the training objective(s) that the typical trainee does not currently possess. Rate the difficulty of acquiring the remaining skills and knowledges.
>
> Enter a number from 0 to 100 using the following scale:
>
> F***

To determine the performance deficit for each task, DEFT II instructs analysts to:

> Examine the statement of the training objective(s). Considering what you know about the typical trainee's background, work experience, and prior training, what proportion of the skills and knowledges required in order to meet the training objective(s) will the trainee still have to learn in order to reach criterion proficiency in the training device?
>
> Enter a number from 0 to 100 using the following scale:
>
> 0 10 20 30 40 50 60 70 80 90 100
>
> 0 = None: the trainee can already meet the training objective(s).
>
> 100 = All: the trainee has to learn all of the skills and knowledges needed to meet the training objective(s).

The program retrieves tasks stored in a data file and displays them to the analysts in sequence so that they may enter their judgments about each task.

Analysts next judge the degree of learning difficulty associated with each task for which they believe a deficit exists. DEFT II tells analysts to:

> Consider each task (subtask) that you indicated a trainee won't be able to perform initially on the training device. Rate the difficulty the typical trainee will have in learning to perform each task (subtask).
>
> Enter a number from 0 to 100 using the following scale:
>
> 0 10 20 30 40 50 60 70 80 90 100
>
> 0 = Very easy to learn; it will take practically no training or practice on the device to reach criterion proficiency on this task (subtask).
>
> 100 = Very difficult to learn; it will take a lot of training or practice on the device to reach criterion proficiency on this task (subtask).

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The program automatically selects those tasks that the analyst rated as having a deficit and displays them in sequence while learning difficulty is rated. In keeping with the multiplicative view of the training problem, learning difficulty judgments are not made for tasks on which there is no deficit in performance.

DEFT III. Once again, analysts develop estimates for the two facets of the training problem: performance deficit and learning difficulty. In keeping with this most detailed and diagnostic level of DEFT, several judgments are required in order to generate estimates. Furthermore, DEFT III analyses are performed at the level of the individual subtasks comprising each task in the training objective. This microscopic examination is designed to take full advantage of the very detailed information about the training system which analysts have at hand. (In cases where a large number of subtasks would render DEFT III analyses too time-consuming, they can be conducted instead at the higher task level, using subtask information to inform judgments about the tasks.)

The performance deficit is estimated for each subtask in terms of a five-point rating scale that characterizes trainee proficiency. DEFT III instructions to the analyst are as follows:

Examine descriptions of the subtasks (tasks) that comprise the training objective(s). Considering what you know about the typical trainee's background, work experience, and prior training, rate the typical trainee's current level of proficiency on each subtask (task).

Enter a number from 0 to 4 using the following definitions:

Rating	Definition
0	No experience, training, or familiarity with this subtask (task). Cannot perform this subtask (task).
1	Has only limited knowledge about this subtask (task). Cannot be expected to perform the subtask (task). Has had orientation only.
2	Has received a complete briefing on the subtask (task). Can perform the subtask (task) only if assisted in every step. Requires much more training and experience. Has had familiarization training only.
3	Understands the subtask (task) to be performed. Can perform the subtask (task) in the trainer. Needs more practice under supervision. Has had procedural training.
4	Has a complete understanding of the subtask (task). Can do the subtask (task) completely and accurately without supervision. Has received skill training.

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The DEFT III program automatically transforms the 0-4 values assigned by the analyst into a weighted performance deficit estimate, i.e., 10, 9, 7, 4, or 0 for the 0-4 estimates, respectively. The weighting is intended to reflect the trainee's position on a skill acquisition curve, with the larger weights being assigned to the bigger performance deficits in a non-linear manner.

The DEFT III estimation of subtask learning difficulty requires the analyst to rate each subtask on which there is a performance deficit in terms of six scales. These scales have been used successfully in other research that related selected task characteristics to the acquisition and retention of skilled performance on a wide variety of Army tasks (Rose, Czarnolewski, Gragg, Austin, Ford, Doyle, & Hagman, 1984).

DEFT III instructs the analyst to estimate learning difficulty in the following manner:

Consider each subtask (task) that you indicated the typical trainee won't be able to perform initially on the training device. For each subtask (task), answer the following six questions:

Question 1. Are job or memory aids intended to be used in performing the subtask (task) on the training device?

Definition - Job and memory aids assist in doing a subtask (task) correctly. They include:

- Documents (SM, Tech Manuals, etc.)
- Instructions printed on the equipment
- Memory joggers (S-A-L-U-T-E).

If the subtask (task) is taught or tested with the use of job or memory aids, enter "0." If not, enter "1."

Question 2. How many steps are required to do the subtask (task)?

Definition - A step is a separate physical activity with a well defined, observable beginning and end point. A subtask (task) may have one step (Identify enemy vehicles) or many steps (those involved in disassembling an M16). If the subtask (task) contains less than 10 steps, enter "0." If the subtask (task) contains 10 steps or more, enter "1."

Question 3. Is there a requirement to perform the steps in the subtask (task) in a definite sequence?

Definition - If all or most of the steps in a subtask (task) must be performed in a specific order, then enter "1." If the order in which the steps are performed is not critical, then enter "0".

Question 4. Does the subtask (task) have a built-in logic so that the trainee knows when he/she is doing it correctly?

Definition - Some subtasks (tasks) consist of steps that form a logical or natural sequence, like fixing a tire or changing a light bulb. Others have steps that seem arbitrary, like many trouble-shooting subtasks (tasks). Some contain a mixture of "natural" and "unnatural" steps. For example, safety steps often break the natural flow and logic of a subtask (task). If the subtask (task) contains a built-in logic, enter "0;" if it does not, then enter "1."

Question 5. What are the mental or thinking requirements of the subtask?

Definition - Repetitive, physical subtasks (tasks) require almost no mental work. Many subtasks (tasks) that look easy have very complex mental requirements, such as planning an attack or trouble-shooting a complex piece of equipment. Consider the number of internal decisions or calculations that must be made in choosing your answer. Also consider the impact of any job aid. Enter "0" if there are few mental requirements. Enter "3" if the subtask (task) is mentally demanding.

Question 6. What are the motor control demands of the subtask (task)?

Definition - Motor control refers to precise finger, hand, or arm movements, not to large body movement. Sheer physical strength is not a factor. For example, lifting a weight or changing a tire does not require much motor control; tracking a target does. Repairing an ammeter gauge does. Enter a "0" if the motor control demands are small. Enter a "3" if the motor control demands are great.

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Because the last two scales were found to contribute relatively more to the prediction of skill acquisition and retention phenomena, they are weighted more heavily. The first four scales can assume values of 1 or 0; the last two scales have values of either 0 or 3.

3. Acquisition Efficiency Analysis

As the second of the two analyses underlying the acquisition component of device evaluation, the acquisition efficiency (AE) analysis describes how rapidly the training deficit will be overcome. AE is an estimate of the quality of training that the device provides to enable trainees to accomplish the device-mediated training objective.

The quality of training is ascertained by examination of the instructional features and training principles that are incorporated in the device. But the evaluation must also extend to extra-device variables such as the quality and motivation of instructor personnel and the pattern of device utilization. It should be noted at this point that the acquisition efficiency analysis does not involve concepts such as fidelity of simulation. Those concepts are dealt with subsequently when the transfer component of device evaluation is described.

The analyst is particularly interested in those aspects of the device and the context surrounding its use that distinguish it as a training device from, for example,

merely providing rote practice on a piece of actual equipment. We describe below how the analyst makes this assessment at each level of DEFT.

DEFT I. The analyst makes an assessment of training efficiency in terms of a single comprehensive rating scale. The DEFT I program instructs the analyst to:

> Examine information about the instructional features of the training device, the training principles it incorporates, the program for its implementation, and the larger training context in which the device is embedded. Consider the performance deficits you have identified and how utilization of the device will overcome these deficits.
>
> To provide "excellent" training, the training system should:
>
> - make the performance requirements of the training objective(s) explicit to the trainee;
> - provide meaningful and understandable feedback to the trainee regarding the results of his performance as soon as possible following his performance;
> - provide sufficient practice where specific and hard-to-learn physical skills are involved; and
> - provide a record of trainee performance.
>
> Rate the quality of the training provided by this training system, considering only the training problems you have identified.
>
> Enter a number from 0 to 100 using the following scale:
>
> F5
> 0 10 20 30 40 50 60 70 80 90 100
>
> 0 = Poor training; the system embodies few if any sound training principles and instructional features.
>
> 100 = Excellent training; the system makes maximum use of sound training principles and instructional features.

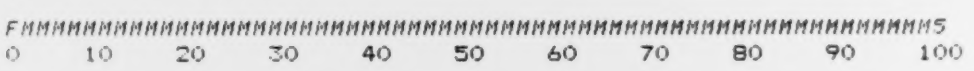
DEFT II. At this more detailed level of analysis, the analyst assesses training efficiency in terms of four scales that represent major training considerations. The first addresses whether or not trainees are given an explicit and clear indication of the criterion performance requirements (e.g., "using this gunnery trainer, you must get second round main gun hits on 9 out of 10 simulated moving tank targets, within 10 seconds of engaging each target, by applying burst on target techniques to adjust fire;" "watch me, here's what successful performance looks like [demonstration];" "when you can perform this task as indicated, you will proceed to the next step in your training."). The second scale estimates the amount of practice that can be given. The third addresses the quality of feedback that trainees receive in response to their control inputs. The fourth scale estimates the extent to which trainees' performance is recorded and made available to them.

The analyst uses the four rating scales to assess the quality of training provided by the device in accordance with the following instructions:

Examine information about the instructional features of the training device, the training principles it incorporates, the program for its implementation, and the larger training context in which the device is embedded. Consider the performance deficits you have identified Rate how well utilization of the device will overcome these deficits.

Enter a number from 0 to 100 using each of the following four scales:

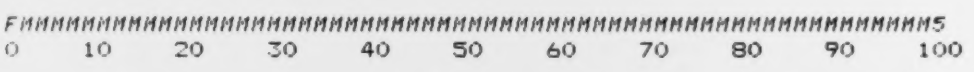
For what percentage of the tasks (subtasks) that must be learned does the training system make the criterion performance requirements explicit to the trainee?



0 = None; performance requirements are not made explicit to trainees.

100 = All; performance requirements are made explicit to trainees on all tasks (subtasks) they must learn.

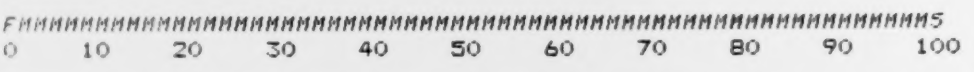
For what percentage of the tasks (subtasks) that must be learned does the training system provide practice?



0 = None; practice is not provided for on any of the tasks (subtasks) which must be learned.

100 = All; practice is provided for on all of the tasks (subtasks) which must be learned.

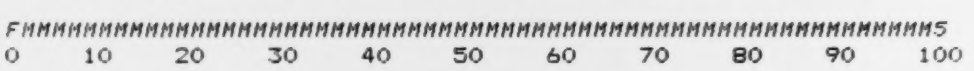
For what percentage of the tasks (subtasks) that must be learned does the training system provide qualitative feedback to the trainees about their performance?



0 = None; feedback about performance is not provided on any of the tasks (subtasks) which must be learned.

100 = All; feedback about performance is provided on all of the tasks (subtasks) which must be learned.

For what percentage of the tasks (subtasks) that must be learned does the training system provide a record of trainee performance?



0 = None; records of trainee performance are not provided for any of the tasks (subtasks) which must be learned.

100 = All; records of performance are provided for all of the tasks (subtasks) which must be learned.

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A single rating about the training device is made on each scale. Information about individual tasks is used to support the four ratings.

DEFT III. At this level of analysis, the analyst uses 11 rating scales to estimate training efficiency. The analyst makes 11 ratings on each subtask for which it has previously been determined that there is a performance deficit. The computer program automatically displays relevant subtasks to the analyst as the ratings are entered.

The 11 rating scales were the result of an extensive culling of nearly 300 training and transfer principles developed previously by Wheaton, Fingerman, Rose, & Leonard (1976) and by Aagard and Braby (1976). Project staff who were experienced in training and instructional design reviewed the entire set of principles in an attempt to coalesce them into a smaller, more manageable set. They eliminated redundant principles and distinguished principles relating to acquisition from those relating to transfer phenomena. In their opinion, the 11 rating scales fairly reflect the essence of the many more specific acquisition principles that were examined.

DEFT III guides the analyst through all 11 scales in the following manner:

Examine information about the instructional features of the training device, the training principles it incorporates, the program for its implementation, and the larger training context in which the device is embedded. Consider the deficits you have identified. Rate how well utilization of the device will overcome these deficits on each subtask (task).

Enter a number from 0 to 100 using each of the following 11 scales:

1. To what extent will the training system (e.g., device, instructor, pattern of device utilization, etc.) make explicit to the trainee, at key stages of training, the nature of the training objective(s) and the trainee's current standing relative to it?

F----------5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all; neither the training objective(s) nor the trainee's standing relative to that objective is made explicit.

100 = Completely; the training objective(s) and the trainee's standing relative to that objective are made explicit throughout training

2. To what extent will the trainee begin with easy subtasks (tasks) and progress to more difficult subtasks (tasks)?

F----------5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all; the material to be learned is not sequenced in terms of learning difficulty

100 = Completely; the material to be learned is sequenced in terms of learning difficulty from easy to hard; the sequence of instruction can be tailored to individual trainee capabilities

3. To what extent will the training system provide trainees with knowledge of results (KOR) of their performance and positive reinforcement (feedback)?

F----------5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all; the training system provides trainees with no feedback about their performance

100 = Completely; the training system provides trainees with explicit feedback about the adequacy of their performance

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4. To what extent will the training system provide for repetition/practice of the material to be learned?

```
F-----+-----+-----+-----+-----+-----+-----+-----+-----+-----5
0     10    20    30    40    50    60    70    80    90    100
```

0 = Minimum practice; there is no practice, rehearsal or repetition of subtasks (tasks)

100 = Maximum practice; there is extensive practice, repetition, rehearsal of subtasks (tasks); the amount of practice is tailored to the individual trainee

5. To what extent will the training system provide for prompting/cueing early in training and gradual fading of prompts/cues as training progresses?

```
F-----+-----+-----+-----+-----+-----+-----+-----+-----+-----5
0     10    20    30    40    50    60    70    80    90    100
```

0 = Not at all; prompts and cues are not employed

100 = Completely; the training system provides prompting and cueing early in training and gradually fades them out late in training

6. To what extent will the training system chunk the material to be learned into small blocks or steps appropriate to the complexity of the subtasks (tasks) and the capabilities of the trainee?

```
F-----+-----+-----+-----+-----+-----+-----+-----+-----+-----5
0     10    20    30    40    50    60    70    80    90    100
```

0 = Not at all; the material to be learned is not organized into chunks

100 = Completely; the material to be learned is organized into chunks; the chunks are tailored to the complexity of the material and the capabilities of each trainee

7. To what extent does the training system make use of mnemonics when these are practicable and available?

```
F-----+-----+-----+-----+-----+-----+-----+-----+-----+-----5
0     10    20    30    40    50    60    70    80    90    100
```

0 = Not at all; although mnemonics could be used, the training system does not employ them

100 = Completely; the training system employs mnemonics to facilitate learning

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8. To what extent does the training system start with a wide tolerance band for correct performance, narrowing it as training progresses?

```
FMMM
```

4. Transfer Problem Analysis

The first of the two analyses underlying the transfer component of device evaluation is the transfer problem (TRP) analysis. TRP represents an estimate of two facets of the performance deficit that trainees who have graduated from the training device bring to the parent equipment: the magnitude of the residual deficit and the difficulty that trainees will have in overcoming it. These two aspects are directly analogous to those on which analysis of the training problem is based.

In this case, however, the magnitude of the performance deficit is defined by different end points. One is actually the same as described earlier. It is the level and type of proficiency associated with an explicit statement of the training-device-mediated training objective. It may be stated, for example, in precisely the same manner as we indicated earlier for the "gunnery trainer" in our discussion of the training problem analysis. The first end point represents criterion proficiency on the training device. The second end point is an exact parallel of the first. It is the level and type of proficiency included in

an explicit statement of the operational performance objective associated with the parent equipment. As such, it is the criterion level of proficiency that the graduate trainee must exhibit on the actual equipment after some specified time (e.g., first trial performance, later performance). We refer to the difference between these two points as the residual performance deficit, the deficit that still exists upon completion of device-mediated training.

After analysts quantify the nature and magnitude of the residual performance deficit, they determine how difficult it will be for trainees, assuming they have reached criterion proficiency on the device, to acquire the kind and level of proficiency that is indicated in the operational performance objective. This time, however, difficulty is characterized in two ways.

First, the analyst focuses on the difficulty of acquiring required skills and knowledge as a function of selected characteristics of the different kinds of operational tasks that are involved. This portion of the difficulty analysis is carried out in precisely the same fashion as it is in the evaluation of the training problem.

Second, the analyst undertakes a series of ratings and comparisons to describe the physical and functional similarity that exists between the training device and the operational equipment. This analysis is undertaken to determine whether there are additional factors that may impede the trainee once he begins working on the parent equipment.

Based upon an extensive review of the transfer of training literature, we have adopted a particular theoretical approach to conceptualizing what takes place cognitively in a transfer situation. In non-technical terms, positive transfer will occur (i.e., trainees will use the skills and knowledge acquired during training, compared to trainees who did not acquire those skills and knowledge) only if the trainee recognizes that the skills and knowledge are applicable to the new situation. The logic of this view is obvious: If you don't realize that certain skills you possess can be used, you won't use them. On the other side of the coin, negative transfer will occur (i.e., trainees who acquired certain skills and knowledge do worse in a new situation as compared to trainees who did not acquire those skills and knowledge) only if they make a "false recognition": They try to employ skills and knowledge previously learned to situations that (to them) seem to apply, but are actually inappropriate.

Most training device designers incorporate this view of positive transfer: Devices are designed to reproduce the operational equipment to the maximum possible extent. "High fidelity" devices are designed so that trainees will recognize that what they learn in the device will be applicable to the operational equipment. However, most device designers do not consider the negative transfer side: If the high-fidelity training device increases the probability that trainees will recognize the similarity to the operational equipment, it is vital that the operational equipment "works" the same way as in the training device. In other words, devices that are highly similar physically to the operational equipment must also be highly similar functionally. Potential problems arise -- in DEFT terminology, the transfer problem is increased -- when physical similarity between the training device and the operational equipment exceeds the functional similarity.

We have incorporated this notion in our concept of "Additional Deficit." In addition to the deficits remaining after completion of the training device regimen (where, presumably, the analyst has considered the physical and functional similarities), we "penalize" a training device if the analyst judges that physical similarity exceeds functional similarity.

Residual performance deficit and learning difficulty combine multiplicatively to define the bulk of the transfer problem. An additional component is added to this estimate whenever the analyst determines that the physical similarity between the device and parent equipment exceeds their functional similarity. In the following sections, we describe the procedures involved in evaluating the transfer problem at each level of DEFT.

DEFT I. At this most general level of DEFT, analysts estimate the magnitude of the transfer problem in terms of four different rating scales. First, they rate the residual performance deficit. Second, they rate the learning difficulty associated with the deficit. Third and fourth, they establish the degree of physical and functional similarity between the device and parent equipment to determine whether the transfer problem is even larger than first suspected.

To assist analysts in rating the magnitude of the residual performance deficit, DEFT I instructs them as follows:

Assume that the trainee has achieved the training objective(s) (i.e., has reached criterion proficiency on the training device). What proportion of the enabling skills and knowledges required in order to reach criterion proficiency on the operational equipment will the trainee still have to learn?

Enter a number from 0 to 100 using the following scale:

```
F#########################################################5
0    10    20    30    40    50    60    70    80    90    100
```

0 = None; the trainee can already meet the operational performance objectives.

100 = All; the trainee has to learn all of the skills and knowledges needed to meet the operational performance objective(s).

To assist them in rating the learning difficulty of deficits he has identified, DEFT I instructs the analysts as follows:

Consider the skills and knowledges that a graduate of the training device must still acquire in order to perform at criterion level(s) on the operational equipment. Rate the difficulty of acquiring the remaining enabling skills and knowledges.

Enter a number from 0 to 100 using the following scale:

```
F#########################################################5
0    10    20    30    40    50    60    70    80    90    100
```

0 = Very easy to learn; it will take practically no training or practice on the operational equipment to learn the skills and knowledges needed to meet the operational performance objective(s).

100 = Very difficult to learn; it will take a lot of training or practice on the operational equipment to learn the skills and knowledges needed to meet the operational performance objective(s).

Analysts estimate physical similarity in the following context:

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Physical similarity is based on the similarity between physical characteristics of the training device and those of the operational situation. The assessment is based on the physical similarity (e.g., location, appearance, and feel) of displays, controls, and ambient conditions in the training and operational setting. Determine the physical similarity between the training device and the operational equipment.

Enter a number from 0 to 100 using the following scale:

```
F----------+----------+----------+----------+----------+----------+----------+----------+----------+----------5
0         10         20         30         40         50         60         70         80         90        100
```

0 = Totally dissimilar; there would be a large noticeable difference, quite apparent to the trainee at transfer and a large performance decrement, given that the trainee could perform at all; specific instruction and practice would be required on the operational equipment after transfer to overcome the deficit.

100 = Identical; the trainee would not notice a difference between the training device and the operational equipment at the time of transfer.

As the final step in the evaluation of the magnitude of the transfer problem, analysts rate functional similarity taking the following into consideration:

Functional similarity is based on the operator's behavior in terms of the information flow from each display to the operator, and from the operator to each control. The assessment is made in terms of the amount of information transmitted from each display to each control and the type of information-processing activity performed by the operator. Determine how functionally similar the training device and operational equipment are.

Enter a number from 0 to 100 using the following scale:

```
F----------+----------+----------+----------+----------+----------+----------+----------+----------+----------5
0         10         20         30         40         50         60         70         80         90        100
```

0 = Totally dissimilar; the trainee acts on completely different types and amounts of information in the training device and the operational equipment; the trainee carries out different information-processing activities.

100 = Identical; the trainee acts on the same types and amounts of information in the training device and the operational equipment; the trainee carries out the same information-processing activities.

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DEFT II. At this intermediate level of DEFT, analysis of the transfer problem proceeds in terms of individual tasks to capitalize on the more detailed information that presumably is available. With the exception of the residual performance deficit ratings, which use a different type of scale, analysts use procedures that are quite similar to those employed in DEFT I.

To determine the residual performance deficit for each operational task, DEFT II instructs analysts to:

> Assume that the trainee can perform all of the tasks (subtasks) comprising the training objective(s) (i.e., has reached criterion proficiency on each task (subtask) in the training device).
>
> For each task (subtask) associated with the operational performance objective(s), enter a value from 1 to 4 as indicated below:

1. Operational task (subtask) was represented in the training objective; most trainees will be able to perform this task (subtask) with minimal exposure to or practice on the operational equipment.
2. Operational task (subtask) was not represented in the training objective; but most trainees will be able to perform this task (subtask) with minimal exposure to or practice on the operational equipment.
3. Operational task (subtask) was represented in the training objective; but most trainees will not be able to perform this task (subtask) with minimal exposure to or practice on the operational equipment.
4. Operational task (subtask) was not represented in the training objective; most trainees will not be able to perform this task (subtask) with minimal exposure to or practice on the operational equipment.

Analysts next judge the degree of learning difficulty associated with each operational task for which they believe there is a residual deficit. DEFT II instructions are as follows:

Consider each operational task (subtask) that you indicated the typical trainee won't be able to perform initially on the operational equipment. Rate the difficulty the typical trainee will have in learning to perform each task (subtask).

Enter a number from 0 to 100 using the following scale:

```
0    10    20    30    40    50    60    70    80    90    100
```

0 = Very easy to learn; it will take practically no training or practice on the operational equipment to reach criterion proficiency on this task (subtask).

100 = Very difficult to learn; it will take a lot of training or practice on the operational equipment to reach criterion proficiency on this task (subtask).

As occurs in similar cases, the computer program automatically displays the appropriate tasks to analysts so that they can enter their estimates of learning difficulty for each instance where they have decided a residual deficit exists.

Still operating at the level of individual operational tasks, analysts next rate physical similarity. When doing so, they attend to the following information:

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Physical similarity is based on the similarity between physical characteristics of the training device and those of the operational situation. The assessment is based on the physical similarity (e.g., location, appearance, and feel) of displays, controls, and ambient conditions in the operational and training tasks (subtasks). Rate the physical similarity between each operational task (subtask) and its counterpart (if any) in the training device.

Enter a number from 0 to 100 using the following scale:

0 10 20 30 40 50 60 70 80 90 100

0 = Totally dissimilar; although the task is represented in the training device, there would be a large noticeable difference quite appparent to the trainee at transfer and a large performance decrement, given that the trainee could perform the task at all; specific instruction and practice would be required for this task (subtask) on the operational equipment after transfer to overcome the deficit.

100 = Identical; the trainee would not notice a difference between the training device and the operational equipment for this task (subtask) at the time of transfer.

As the final step in assessing the magnitude of the transfer problem, analysts rate the functional similarity between device and actual equipment tasks. To help them, analysts are instructed as follows:

Functional similarity is based on the operator's behavior in terms of the information flow from each display to the operator and from the operator to each control. The assessment is made in terms of the amount of information transmitted from each display to each control and the type of information-processing activity performed by the operator. Rate the functional similarity between each operational task (subtask) and its counterpart (if any) in the training device.

Enter a number from 0 to 100 using the following scale:

0 10 20 30 40 50 60 70 80 90 100

0 = Totally dissimilar; for this task, the trainee acts on completely different amounts and types of information in the training device and the operational equipment; the trainee carries out different information-processing activities in the two versions of the task.

100 = Identical; for this task the trainee acts on the same types and amounts of information in the training device and the operational equipment; the trainee carries out the same information-processing activities in the two versions of the task.

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DEFT III. The DEFT III analysis of the transfer problem also has four components: residual deficit, learning difficulty, physical similarity, and functional similarity. The rating procedures for the first two of these are essentially the same as used in evaluation of the training problem. And, as in those earlier analyses, the focus is at the subtask level of description. The two similarity analyses involve the same kind of scale as used in DEFT II but this time they are applied to specific controls and displays housed in the training device and operational equipment.

Analysts begin to scope out the transfer problem by determining how much residual performance deficit there is. Toward that end, DEFT III provides them with the following instructions:

> Consider descriptions of the subtasks (tasks) that comprise the training objective(s), the subtasks (tasks) that comprise the operational performance objective(s), as well as descriptions of the training device and operational equipment, including their controls and displays. Rate the typical trainee's current level of proficiency on each operational subtask (task).
>
> Assume that the typical trainee can perform all of the subtasks (tasks) comprising the training objective(s) (i.e., has reached criterion proficiency on each subtask [task] in the training device).
>
> For each subtask (task) associated with the operational performance objective(s), enter a number from 0 to 4 using the following definitions:

Rating	Definition
0	No experience, training, or familiarity with this subtask (task). Cannot perform this subtask (task).
1	Has only limited knowledge about this subtask (task). Cannot be expected to perform the subtask (task). Has had orientation only.
2	Has received a complete briefing on the subtask (task). Can perform the subtask (task) only if assisted in every step. Requires much more training and experience. Has had familiarization training only.
3	Understands the subtask (task) to be performed. Can perform the subtask (task) in the trainer. Needs more practice under supervision . Has had procedural training.
4	Has a complete understanding of the subtask (task). Can do the subtask (task) completely and accurately without supervision . Has received skill training.

Analysts next consider the learning difficulty associated with each subtask for which they have indicated a residual deficit exists. They make this assessment in terms of the six task characteristic scales previously described. To aid them in assessing the degree of learning difficulty, DEFT III gives analysts the following instructions:

> Consider each subtask (task) that you indicated the typical trainee won't be able to perform initially on the operational equipment. For each subtask (task), answer the following six questions.
>
> Question 1. Are job or memory aids intended to be used in performing the subtask (task) on the operational equipment?
>
> Definition - Job and memory aids assist in doing a subtask (task) correctly. They include:
>
> - Documents (SM, Tech Manuals, etc.)
> - Instructions printed on the equipment
> - Memory joggers (S-A-L-U-T-E).
>
> If the subtask (task) is taught or tested with the use of job or memory aids, enter "0." If not, enter "1."

Question 2. How many steps are required to do the subtask (task)?

Definition - A step is a separate physical activity with a well defined, observable beginning and end point. A subtask (task) may have one step (Identify enemy vehicles) or many steps (those involved in disassembling an M16). If the subtask (task) contains less than 10 steps, enter "0." If the subtask (task) contains 10 steps or more, enter "1."

Question 3. Is there a requirement to perform the steps in the subtask (task) in a definite sequence?

Definition - If all or most of the steps in a subtask (task) must be performed in a specific order, then enter "1." If the order in which the steps are performed is not critical, then enter "0".

Question 4. Does the subtask (task) have a built-in logic so that the trainee knows when he/she is doing it correctly?

Definition - Some subtasks (tasks) consist of steps that form a logical or natural sequence, like fixing a tire or changing a light bulb. Others have steps that seem arbitrary, like many trouble-shooting subtasks (tasks). Some contain a mixture of "natural" and "unnatural" steps. For example, safety steps often break the natural flow and logic of a subtask (task). If the subtask (task) contains a built-in logic, enter "0;" if it does not, then enter "1."

Question 5. What are the mental or thinking requirements of the subtask?

Definition - Repetitive, physical subtasks (tasks) require almost no mental work. Many subtasks (tasks) that look easy have very complex mental requirements, such as planning an attack or trouble-shooting a complex piece of equipment. Consider the number of internal decisions or calculations that must be made in choosing your answer. Also consider the impact of any job aid. Enter "0" if there are few mental requirements. Enter "3" if the subtask (task) is mentally demanding.

Question 6. What are the motor control demands of the subtask (task)?

Definition - Motor control refers to precise finger, hand, or arm movements, not to large body movement. Sheer physical strength is not a factor. For example, lifting a weight or changing a tire does not require much motor control; tracking a target does. Repairing an ammeter gauge does. Enter a "0" if the motor control demands are small. Enter a "3" if the motor control demands are great.

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In the two final ratings, DEFT III leads analysts through a series of similarity judgments about pairs of controls and displays. One member of each pair comes from the training device; the second member comes from the operational equipment. (The initial listing and pairing of controls and displays is accomplished as part of data base maintenance activities as described in Appendix A.)

When they choose the physical similarity option on the DEFT III menu, analysts receive the following guidance:

Physical similarity is based on the similarity between physical characteristics of the training device and those of the operational situation. The assessment is based on the physical similarity (e.g., location, appearance, and feel) of displays, controls, and ambient conditions in the operational and training tasks (subtasks).

Rate the physical similarity between each operational display and control and its counterpart (if any) in the operational equipment.

Enter a number from 0 to 100 using the following scale:

FMMM

Functional similarity is based on the operator's behavior in terms of the information flow from each display to the operator and from the operator to each control. The assessment is made in terms of the amount of information transmitted from each display to each control and the type of information-processing activity performed by the operator.

Rate the functional similarity between each operational display and control and its counterpart (if any) in the operational equipment.

Enter a number from 0 to 100 using the following scale:

```
F----------+----------+----------+----------+----------+----------+----------+----------+----------+----------5
0         10         20         30         40         50         60         70         80         90        100
```

0 = Totally dissimilar; for this display/control the trainee acts on completely different amounts and types of information in the training device and the operational equipment; the trainee carries out different information-processing activities in the two versions of the display/control.

100 = Identical; for this display/control the trainee acts on the same types and amounts of information in the training device and the operational equipment; the trainee carries out the same information-processing activities in the two versions of the display/control.

Assessment of physical and functional similarity completes the evaluation of the transfer problem. The final set of analyses requires an examination of transfer efficiency -- how well the training device has prepared the trainee to perform on the parent equipment.

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5. Transfer Efficiency Analysis

The second of the two major analyses underlying the transfer component of device evaluation is the transfer efficiency (TT) analysis. TT is an estimate of the quality of training that the device provides to enable trainees to accomplish the operational performance objective on the parent equipment. TT is concerned with those instructional features and principles that contribute to transfer of training.

In order to estimate how efficiently transfer of training will occur, the analyst examines features of the training device, considers the transfer principles that it incorporates, and attends to other factors in the larger training and transfer context. The analysis parallels the training efficiency analysis in concept but involves different sets of scales. The ratings required by each level of DEFT are described below.

DEFT I. Analysts make their assessment of transfer efficiency in terms of a single global rating in keeping with this most general level of DEFT. The DEFT I progam instructs analysts to:

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Consider the statement of the operational performance objective(s), as given in the Training Device Requirement (TDR), the statement of the training objective(s), and descriptions of the operational equipment and the training device.

Consider the instructional features and training principles that are included in the device to increase the probability that the skills and knowledges acquired on the device will be used effectively in the operational situation. Rate how well the training device will promote transfer to the operational situation.

Enter a number from 0 to 100 using the following scale:

```
FHHH
```

a particular operational task is represented in the training device than with the fidelity of the representation. The second scale is concerned with the conditions of practice in the device. Are they (e.g., difficulty, feedback, reinforcement) gradually changed to levels expected in the real world or are they sustained at unreal levels in the training environment? The third scale rates how much practice the trainee will have in the device, preparing him for the eventual shift to the parent equipment. All three scales are used to make judgments about the training device overall. The ratings are driven by information about component tasks.

In order to assist analysts, DEFT II directs them as follows:

Consider the statement of the operational performance objective(s), as given in the Training Device Requirement (TDR), the statement of the training objective(s), and descriptions of the operational equipment and the training device.

Rate how well the training device will promote transfer to the operational situation. Consider the instructional features and training principles that are included in the device to increase the probability that the skills and knowledges acquired will be used effectively in the operational situation.

Enter a number from 0 to 100 using each of the following three scales:

What percentages of the tasks (subtasks) that must be learned in the device are realistic and relevant in the sense that they are similar to the tasks that are performed in the real world?

F----------5
0 10 20 30 40 50 60 70 80 90 100

0 = None; the learning tasks are not realistic, relevant or similar to those in the real world.

100 = All; the learning tasks are realistic, relevant or similar to those in the real world.

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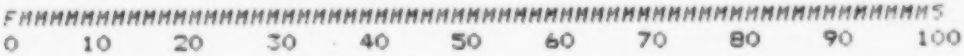
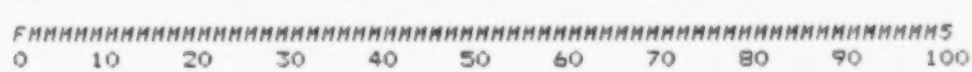
For what percentage of the tasks (subtasks) that must be learned in the device are the conditions of practice late in training made to approximate those in the real world?



0 = None; late in training the conditions of practice do not approximate those likely to be encountered in the real world.

100 = All; late in training the conditions of practice are made to approximate those in the real world on all of the tasks trainees must learn in the device.

For what percentage of the tasks (subtasks) that must be learned in the device is an extensive amount of practice given?



0 = None; not even a single task is practiced extensively.

100 = All; every task that trainees must learn in the device is practiced extensively.

DEFT III. The transfer efficiency analysis at this deepest level of DEFT is carried out for each individual subtask. Analysts rate the quality of the principles and features incorporated in the device to promote transfer. They use eight different scales for this purpose. These scales were obtained from the same culling process described previously for the companion set of training efficiency scales.

The DEFT III analysts make their ratings in accordance with the following guidance:

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Consider the statement of the operational performance objective(s), as given in the Training Device Requirement (TDR), the statement of the training objective(s), and descriptions of the operational equipment and the training device.

Rate how well the training device will promote transfer to the operational situation. Consider the instructional features and training principles that are included in the device to increase the probability that the skills and knowledges acquired will be used effectively in the operational situation.

Enter a number from 0 to 100 using each of the following eight scales:

To what extent is the subtask (task) that must be learned in the device realistic and relevant in the sense that it is similar to the subtask (task) that is performed in the real world?

F----------5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all; the device subtask is not realistic, relevant or similar to the real world

100 = Completely; the device subtask is realistic, relevant or similar to a corresponding subtask in the real world

To what extent are features of the real-world job setting used to cue trainees (e.g., to recall knowledge, to form mnemonics, to distinguish patterns, to anticipate certain messages, to recall procedures, etc.)?

F----------5
0 10 20 30 40 50 60 70 80 90 100

0 = Not at all; the device does not present real-world cues to the trainees for this subtask

100 = Completely; the device presents real-world cues to trainees for this subtask

To what extent will the training system (e.g., device, instructor, etc.) make explicit to the trainee the relationship between the training objective(s) and the real-world performance objectives for this subtask?

F----------5
0 10 20 30 40 50 60 70 80 90 100

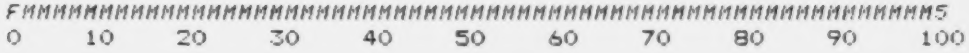
0 = Not at all; the relationship of training objective(s) to the real-world is not made explicit to trainees

100 = Completely; the relationship of the training objective(s) to the real world is made explicit to trainees

To what extent later in training does the training system gradually match the levels of "instructional supports" (e.g., frequency of reinforcement, timing and frequency of KOR, guides/prompts, etc.) to operational levels for this subtask?

FMMM

To what extent will the training system (e.g., device, instructor, pattern of device utilization) permit trainees to practice in the device until they can demonstrate a job entry level of skill on this subtask?



0 = Not at all; the amount of practice trainees receive will not enable them to perform at a job entry skill level

100 = Completely; the amount of practice trainees receive will enable them to perform at a job entry skill level

6. Output of DEFT Analysis

In the four preceding chapters, we have described the procedures that an analyst uses to carry out the four major DEFT analyses. In this last chapter, we describe the kinds of output that each level of DEFT provides. These are the data to which the analyst refers when reaching an overall assessment of training device effectiveness or when considering specific aspects of a device for diagnostic purposes. We begin with an overview of the rating data and the seven indexes of effectiveness that are generated from those data. We then discuss the computation of each index, indicating how each is derived for DEFT I, II, and III.

Overview

Once a training device has been analyzed following the procedures described in the preceding chapters, a great deal of information is available in the form of rating scale estimates. DEFT I provides eight different ratings. Assuming there are five tasks that have to be assessed, DEFT II produces up to 37 different ratings or pieces of information. Assuming that each of five tasks have two

subtasks, each of which has one display and one control, DEFT III generates up to 370 different ratings. In each instance, but particularly for DEFT II and III levels of analysis, the output consists of much more raw rating data than can be readily assimilated. This is especially true whenever the analyst wants to achieve some closure about device effectiveness that is an overall reflection of the many detailed judgments that have been made. Accordingly, each DEFT program computes and displays seven summary indexes of device effectiveness.

Each summary index is keyed to evaluation concepts inherent in the deficit model of device effectiveness and represented in the four primary DEFT analyses: the acquisition problem, the training efficiency, the transfer problem, and the transfer efficiency analyses. Raw rating data are aggregated to produce a summary index that consolidates the results of each of these four analyses. The two training indexes and the two transfer indexes are then aggregated into higher level "acquisition" and transfer indexes. Finally, these two indexes are combined to form a single, overall index of training device effectiveness.

During the development of the seven summary indexes, an attempt was made to provide for comparability of output across levels of DEFT. We wanted each level of analysis to result in the same set of indexes. Further, we wanted each index to reflect the same sets of concepts and considerations. Finally, we wanted the numerical output of DEFT I, II, and III analyses to be equivalent whenever a given training device was subjected to two or more levels of analysis. Comparability of output was achieved by means of different computational procedures at each level of DEFT. The computation of each index is described in the following sections for DEFT I, II, and III.

DEFT I Indexes

Computations involved in the seven DEFT I indexes are presented below in algebraic form. Brief explanatory comments are also provided.

Training problem (TP). TP is treated as the product of the performance deficit (PD) and learning difficulty (D) ratings. Therefore,

$TP = \frac{PD \times D}{100}$. Since both PD and D can assume scale values between 0 and 100, TP was normalized to range from 0 to 100. This normalization was done for many of the parallel indexes.

Acquisition efficiency (AE). AE is obtained directly from the rating of training efficiency. Accordingly,

$AE = \sqrt{\frac{Rating}{100}}$. The rating can assume scale values of 0 to 100. But for reasons that will become clear in a moment, the DEFT I program assigns a value of "1" to zero ratings on this scale. As a consequence, AE ranges from .01 to 1.

Acquisition (A). The index reflecting the acquisition or training component of device evaluation is obtained by combining the training problem (TP) and acquisition efficiency (AE) indexes. We wanted an index that would yield a "poor" score to a device that incorporated a large training problem and did not deal with it efficiently. Dividing TP by AE produced a coefficient with the desired properties. Therefore,

$$A = TP/AE,$$

where TP ranges from 0 to 100 and AE can vary from .01 to 1.0. A, therefore, can range between 0 and 10,000. An "effective" device has a relatively low value on A, particularly if it stems from a fairly large training problem (TP) that is handled quite efficiently (AE).

Transfer problem (TRP). The transfer problem is treated as the product of the residual performance deficit (RPD) and residual learning difficulty (RLD) ratings. This value is increased if there are any additional deficits (AD) stemming from the fact that functional similarity (FS) is less than physical similarity (PS). Addressing the additional deficits (AD) first,

$$AD = PS - FS ,$$

where both scales range from 0 to 100. Whenever FS>PS, AD is set to zero, since in this case there is no negative impact on the trainee. AD ranges from 0 to 100. The transfer problem (TRP) becomes,

$$TRP = \frac{RPD \times RLD}{100} + AD.$$

The index ranges between 0 and 200.

Transfer efficiency (TT). This index is computed in a manner analogous to AE:

$$TT = \sqrt{\frac{Rating}{100}} ,$$

and, given the conversion of zero ratings to "1", ranges from .01 to 1.0.

Transfer (T). This index reflects the transfer component of device evaluation and is obtained by combining the transfer problem (TRP) and transfer efficiency (TT) indexes. The index is the transfer analog of A. In this case,

$$T = \frac{TRP}{TT},$$

an index that ranges between 0 and 20,000. The "better" of two devices will have a smaller score on this index.

Total effectiveness (Σ). To make the various deficit analyses complete, the single index that represents overall device effectiveness is Σ,

$$\Sigma = A + T.$$

This represents the total deficit that use of any particular device-mediated training system entails with respect to a given operational performance objective. A device with a larger total deficit will take more time, cost more, etc., to reach the operational objective than will an alternative device which has a smaller deficit. Such comparisons between training device alternatives are direct when they address the same operational performance objective(s). However, comparing training devices when different operational performance objectives are involved

requires the incorporation of additional decision rules. For example, is a training system designed for a "deficit" of (e.g.) 100 worth twice as much as a training system designed for a deficit of 50? These and similar questions are not included in our current DEFT formulations.

DEFT II Indexes

For all intents and purposes, the seven DEFT indexes are identical to those described for DEFT I. The only major computational difference is that DEFT II ratings are averaged over the number of tasks evaluated in order to generate the higher level indexes.

The seven DEFT II indexes are as follows:

$$TP = \frac{\sum_{i=1}^{n}(PD_i \times D_i)}{100\ n} \quad ,$$

where n is the number of tasks and PD is a rating from zero to 100.

$$AE = \sqrt{\frac{\sum_{i=1}^{n} Rating_i}{400}} \quad ,$$

where "zero" ratings are assigned a "1."

$$A = TP/AE.$$

$$TRP = \frac{\sum_{i=1}^{n}(RPD_i \times RLD_i)}{40} + AD,$$

where the RPD values of 1 and 2 are assigned 0, and the value of 3 and 4 are given a 1. Furthermore, in this computation

$$AD = \frac{\sum_{i=1}^{n}(PS - FS)_i}{n}, \text{ with the restriction that when}$$

FS>PS, then (PS-FS) = 0.

$$TT = \sqrt{\frac{\sum_{i=1}^{3} Rating_i}{300}}, \quad \text{where "zero" ratings are assigned}$$

a "1."

$$T = TRP/TT.$$

$$\Sigma = A + T.$$

DEFT III Indexes

The DEFT III indexes are similar to those for DEFT I and II. The only major computational difference is that DEFT III ratings are averaged over the number of subtasks evaluated. The computations of the various indexes are as follows:

$$TP = \frac{\sum_{i=1}^{n} (PD_w \times D_{sum})_i}{n}$$, where PD_w is a

weighting of the performance deficit; i.e., the 0, 1, 2, 3, or 4 rating is transformed into a 10, 9, 7, 4, or 0, respectively. In this formulation n is the number of subtasks that were evaluated. Dsum is the sum of the six task characteristic ratings of each subtask and assumes a value of 0 to 10.

$$AE = \sqrt{\frac{\sum_{i=1}^{n} \overline{R}_i}{100n}}, \text{ where } \overline{R} = \frac{\sum_{i=1}^{11} Rating_i}{11},$$

the average rating on each subtask and n is the number of subtasks. Again, "0" ratings are assigned a "1."

$$A = TP/AE.$$

$$TRP = \frac{\sum^{n} (RDP_w \times RLD_{sum})_i}{n} + AD, \text{ where}$$

$$AD = \frac{\sum^{C+D} (PS - FS)_i}{C+D}$$

and C + D is the total number of display and control pairings that are evaluated. Again, when FS>PS, (PS - FS) = 0.

$$TT = \sqrt{\frac{\sum_{i=1}^{n} \bar{R}_i}{100}}, \text{ where } \bar{R} = \sum_{j=1}^{p} \frac{\text{Rating}_j}{8}$$

$$T = TRP/TT.$$

$$= A + T.$$

Summary

The indexes described above provide a means of consolidating the large amount of rating data that a DEFT analysis may produce. The indexes are derived from concepts within the deficit model of device effectiveness which in turn comes from a more general program evaluation perspective. Given the conceptual framework in which they are grounded, the indexes should provide training device designers and evaluators with useful forecasts of effectiveness: overall; from a training or transfer point of view; or in terms of more fundamental concepts having to do with the magnitude of the training or transfer problem and the efficiency with which it is addressed.

In fact, designers can analytically introduce "design changes," change their ratings to reflect the impact of the design modifications, and then reexamine one or more summary indexes to assess the impact of the hypothetical modifications on training device effectiveness. Using DEFT in this manner will force training developers to pin down their assumptions about various aspects of the training system and to make them explicit. This may be the single most important contribution that DEFT in its present form can make.

The actual forecasts that stem from DEFT, however, need to be examined as part of additional research and development. In particular, the degree of agreement among analysts who use DEFT needs to be ascertained, the scale properties of the summary indexes need to be determined and above all else, the forecasts resulting from DEFT analyses need to be validated against empirical acquisition and transfer data. The next report in this series (Rose & Martin, 1984) describes work in the first two of these directions. Empirical validation of DEFT lies in the future.

REFERENCES

Aagard, J.A., & Braby, R. (1976). **Learning guidelines and algorithms for types of training objectives.** TAEG Report No. 23. Orlando, FL: Training Analysis and Evaluation Group.

Rose, A.M., Czarnolewski, M.Y., Gragg, F.F., & Austin, S.H. (AIR), Ford, P., & Doyle, J. (HumRRO), and Hagman, J.D. (ARI). (1984). **Acquisition and retention of soldiering skills,** Final Report. Washington, DC: American Institutes for Research.

Rose, A.M., & Martin, A.W. (1984). Forecasting device effectiveness: III. Analytic assessment of DEFT, Technical Report. Washington, DC: American Institutes for Research.

Rose, A.M., & Wheaton, G.R. (1984). **Forecasting device effectiveness: I. Issues,** Technical Report. Washington, DC: American Institutes for Research.

Wheaton, G.R., Fingerman, P.W., Rose, A.M., & Leonard, R.L., Jr. (1976). **Evaluation of the effectiveness of training devices: Elaboration and application of the predictive model,** Research Memorandum 76-16. Arlington, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

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DEFT User's Manual

Overview

DEFT is a set of interactive programs that guide you, the user, through an evaluation of the potential effectiveness of a training-device-based training system. When you complete an evaluation, you will have a numerical estimate of device effectiveness, and diagnostic information on what the potential problems or weaknesses in the device may be.

A DEFT evaluation can be conducted at three different levels of analysis. The level to use depends upon the types and amounts of information you have available and the degree of diagnosticity desired. You can start at a very general level, and, as more information becomes available, you can conduct more detailed analyses.

To conduct a given level of analysis, you must first assemble necessary and available descriptive information about the training device and the operational equipment. At the most general level -- DEFT I -- a device evaluation can be conducted without entering any descriptive

information on the computer. To conduct a DEFT II analysis, you must first enter a list of tasks or subtasks included in the Training Device Requirement statement of the training objective(s) and a list of tasks or subtasks included in the operational performance objective for the present equipment. For the most detailed evaluation -- DEFT III -- you must enter the list of subtasks mentioned above and a list of the displays and controls used in each training and operational subtask.

Once the necessary data bases have been constructed, DEFT will lead you through the level of analysis you have chosen. When you complete an analysis, DEFT will compile your results and generate effectiveness estimates. It can also present detailed information on components of your ratings.

DEFT was written for use on an IBM PC equipped with a dual disk drive. All of the DEFT programs are contained on one floppy disk. A second floppy disk, the DATA disk, will contain all of the descriptive information and your ratings pertaining to a training device.

Basic Operation of DEFT

DEFT is menu driven. You can conduct analyses on the computer without having to type in a large variety of commands. You can use DEFT by moving between menus that appear on your computer screen and selecting options from those menus.

DEFT is an interactive system. As you work on the computer, DEFT will prompt you along, presenting information and asking for ratings depending on your responses. You can review, change, and add to your ratings easily.

You need to know only four commands to operate DEFT:

- **BUILD** followed by the name of the device to be evaluated simply creates and names a set of internal files in the programs. You will use this command only once: when you begin your evaluation of a device.
  Example: **BUILD ABC** will create all the internal files needed to conduct all DEFT analyses for a device named ABC.

- **MAINT** followed by the name of the device to be evaluated is used to create, edit, and modify the various data bases used in DEFT. When you

type **MAINT**, you will see a menu of seven options, allowing you to create files or update any of the files you have created. Example: **MAINT ABC** will allow you to enter the information regarding the tasks and subtasks trained by device ABC, the tasks and subtasks required for performance on operational equipment XYZ, and the controls and displays used for each task and subtask on both device ABC and operational equipment XYZ.

- **DEFT** followed by the name of the device to be evaluated allows you to actually conduct the evaluation analyses. When you type **DEFT ABC**, you will first see a menu with four options: DEFT I, DEFT II, DEFT III, and EXIT. When you choose any of the first three options, you will see a longer menu. This menu displays the names of each analysis you can perform. Example: **DEFT ABC** will display

  (1) DEFT I

  (2) DEFT II

  (3) DEFT III

  (4) EXIT

Pressing 1, 2, or 3 will display the larger menu of analyses for the level of DEFT you have chosen.

- **LIST** followed by the name of the device to be evaluated allows you to review all ratings you have previously made. Using this command, you can quickly locate specific ratings and can produce printed records of all or part of the analyses you choose to conduct.
  Example: **LIST ABC** will allow you to review all of your ratings for device ABC.

Thus, when using DEFT, you will first **BUILD** the computer files; then, you will enter the relevant data lists (**MAINT**); you will conduct any or all of the DEFT evaluations (**DEFT**); and you will review any or all of your ratings (**LIST**). You will not need to know any other computer commands; for all other interactions between you and the computer, DEFT will prompt you as to what you should do.

Getting Started with DEFT

You do not need extensive knowledge of the IBM PC to use DEFT. You will use the regular typewriter keyboard to enter all of the information used by DEFT. Any other keys that you will use will be explained as they arise.

To begin using DEFT, do the following five steps:

1. With the IBM PC off, insert the DEFT program floppy disk into disk drive A (the left of the two drives). Remember to close the cover of the disk drive.

2. Insert the DATA floppy disk into disk drive B (the right of the two drives).

3. Turn the IBM PC on. Make sure the display terminal is on. Make sure the printer is on if one is being used.

4. Wait for the prompt **B>** to appear.

5. Type in the appropriate command (**BUILD**, **MAINT**, **DEFT**, or **LIST** followed by the name of the device to be evaluated).

   NOTE: You do not need an attached printer to use DEFT. However, you need one if you desire printed records of your analyses. The procedures to get

printed records are straightforward: Whenever you want to print what is on the screen at any time, press the keys marked **Pr+Sc** and ⇧ simultaneously. This will print the entire contents of the screen that you are currently viewing.

Evaluating a Device: BUILD and MAINT

Once you have loaded DEFT into the PC by performing the above steps, you are ready to begin evaluating a device. There are two things you must do before actually starting to rate the device: first, you must **BUILD** the necessary computer files, and second, you must enter the relevant data bases using the **MAINT** command.

BUILD

Your first step is to create the necessary computer files for the device you will be evaluating. This is done only once for a device, and must be done before you can conduct any analyses.

To create these files:

1. Load DEFT into the PC (steps 1-5, A-6).

2. When you see the **B>** prompt, type the word BUILD followed by a space, then the name of the device. This name can be any combination of letters and numbers up to eight characters; however, do not include a space as part of the name. After you type BUILD device name, hit the ENTER key (↵ on the keyboard).

   Example:

   B> BUILD TEST (hit ENTER)

3. The PC will then display the following:

   BUILDING DEVICE, CONTROL DISPLAY, AND TITLE FILES

   Hit any key to continue

At this point, do just as the display says: hit any key to continue.

4. The PC will then display:

   BUILD COMPLETED

   and will return to the B> prompt, awaiting your next command.

NOTE: You can type in commands, device names, etc., in either upper or lower case letters. The PC will recognize the names as the same, regardless of how you enter them.

MAINT

Your next step is to create the data bases needed to conduct the various analyses. To conduct a DEFT I evaluation, you do not have to enter any further information at this point. However, you should have all relevant information -- task descriptions, the statements of the Training Device Requirements and operational task requirements, the displays and controls used in both the training device and the operational equipment, information on the target trainee population, instructional features of the device, device utilization information, etc. -- available as reference information.

You can conduct DEFT II evaluations at either the task or subtask level. Your descriptions of the performance to be trained on the training device and to be performed in the operational situation must be entered in the PC at the level at which you want to conduct the analyses. In concrete terms, for DEFT II analyses you will need:

- the list of tasks and/or subtasks to be trained on the training device;
- the list of tasks and/or subtasks comprising the operational performance objective; and

- the "commonality" between these two lists -- that is, you must identify the tasks and/or subtasks that are common to the two lists.

DEFT III evaluations are conducted normally at the subtask level. In addition to the above requirements, you will also need:

- a list of the displays and controls used in each subtask to be trained on the training device;

- a list of the displays and controls used in each subtask to be performed in the operational situation; and

- the correspondence between these two lists -- that is, the displays and controls in the training device that correspond to displays and controls used in the operational situation.

You should consider these data bases as integral components of your evaluation. As you obtain more information, these data bases will be added to, modified, and updated. A device evaluation can become more comprehensive and diagnostic as the data bases become more specific and

detailed. DEFT allows you to change these data bases at any time.

MAINT Operations

To begin entering your data bases:

1. Load DEFT into the PC (steps 1-5, A-6).

2. When you see the **B>** prompt, type the word MAINT followed by a space, then the name of the device that you used in the BUILD step, then hit the ENTER key.

   Example:

   B> MAINT ABC (hit ENTER)

3. The PC will then display the following:

Data Base Maintenance

(1) Training Device - Task and Subtask Maintenance

(2) Training Device - Control and Display Maintenance

(3) Operational Equipment - Task and Subtask Maintenance

(4) Operational Equipment - Control and Display Maintenance

(5) Commonality Analysis

(6) Similarity Matching

(7) EXIT PROGRAM

Enter Option

You will then type in the number of the option you want to perform (DO NOT HIT ENTER). We will discuss each Data Base Maintenance option in turn.

(1) Training Device - Task and Subtask Maintenance

You use the first option to enter the training device task and/or subtask names into DEFT.

When you select Option 1, the following will appear on the screen:

(1) Training Device - Task and Subtask Definition

Enter Title of Training Device

Title =

Hit 'F1' to List Training Device Tasks and Subtasks
Hit 'F2' to List Operational Equipment Tasks and Subtasks
Hit 'F3' to List Training Device Controls and Displays

Hit 'F4' to List Operational Equipment *Control and Displays*

We will discuss the meaning of the directions at the bottom of the screen after we explain how to enter task/subtask names and display and control information.

At this point, type the name of the training device and hit ENTER. You will only have to enter this name once; when you use this option again, the PC will not ask for the device name.

The screen will now change to:

(1) Training Device - Task and Subtask Definition

Enter Training Device Task.Subtask number 0000.0000

Notice that DEFT allows up to 9999 tasks, each with 9999 subtasks. You will now enter the task/subtask titles for those addressed by the training device.

1. For task titles, type in a number from 1 to 9999 and hit ENTER. Suppose you start with "1." The screen will display

   Task.Subtask = 1.0000
   Title =

NOTE: It is useful to enter tasks in the sequence in which they are performed, numbering them sequentially.

2. Type in the title of the first task and hit ENTER. Task (and subtask) titles can be as long as 60 alphanumeric characters, including spaces. Suppose your first task is titled BEGIN. You type in BEGIN and hit ENTER.

3. DEFT will now prompt you for another task number:

Enter Training Device Task.Subtask number 0000.0000

You type in another number and hit ENTER. As before, you will be asked for the task title.

4. After you have entered the last task title and

Enter Training Device Task.Subtask number 0000.0000

is displayed on the screen, you return to the Data Base Maintenance menu by hitting the **ESC** key near the top left-hand corner of the keyboard.

If you want to enter subtask titles, you follow almost exactly the same procedure above; the sole difference is that subtasks are numbered as decimals. Suppose task BEGIN

has two subtasks: SET UP and PRESS GO. These would be entered as subtasks 1.1 and 1.2 in the above procedure. For example, with

Enter Training Device Task.Subtask number 0000.0000

displayed on the screen, you would type in **1.1** and hit ENTER. You would then see

Task.Subtask = 1.1000

Title =

You would now type in SET UP and hit ENTER. Continue in this manner until all subtask titles are entered. Then hit ESC to return to the Data Base Maintenance menu.

(2) Training Device - Control and Display Maintenance

You use this option to enter the controls and displays used in each subtask trained in the training device. This information is needed only for a DEFT III analysis; it need not be entered for DEFT I or DEFT II.

When you select Option 2 from the Data Base Maintenance menu, the following will appear on the screen:

(2) Training Device - Control and Display Maintenance

Enter Training Device Task.Subtask number 0000.0000

Now type in the number of the subtask for which you will be entering the displays and controls. For example, suppose subtask 1.1, which we named SET UP above, involved pressing a pushbutton and observing a reading on a meter.

You would now type **1.1** and hit ENTER. The screen will now display:

(2) Training Devices - Control and Display Maintenance

Task.Subtask = 1.1000

Title = SET UP

Enter Control or Display number

If you entered a subtask number for a subtask that you had not previously entered, DEFT will display an error message:

SUBTASK NOT FOUND IN DATA BASE

and prompt you for another subtask number.

Assuming you enter the number of a subtask that is in the data base, DEFT is now asking you to provide a number for the display or control you want to enter. Type in a number and hit ENTER.

NOTE: Again, you will find it useful to number displays and controls sequentially.

Suppose you number the pushbutton as "1" and the meter as "2." You would type in **1** and hit ENTER. The screen will now display:

(2) Training Device - Control and Display Maintenance

Task.Subtask = 1.1000

Title = SET UP

CONTROL/DISPLAY = 1.1000.1

Title =

You now type in **Pushbutton** and hit ENTER. DEFT will now prompt you for the next control or display number. In our example, you would now type in **2** and hit ENTER. When prompted for the title, you would type in **meter** and hit return.

When you finish entering all the displays and controls for a subtask, hit **ESC**. DEFT will now prompt you for the number of another subtask. Repeat the above procedures until you have entered all the displays and controls in your list. When you finish, hit ESC to return to the Data Base Maintenance menu.

NOTE: It is important that you maintain a list of the numbers you assign to each display or control. These numbers will be used later in other analyses. Also, when the same display or control is used in more than one subtask, give it a new number each time it is used.

(3) Operational Equipment - Task and Subtask Maintenance

You will use this option to enter the operational task/subtask names associated with the parent equipment into DEFT. The procedures are identical to those you use to enter the training device task/subtask names, described on p. A-12 above.

(4) Operational Equipment - Control and Display Maintenance

You will use this option to enter the displays and controls used in each operational subtask. Follow the same procedures you used in entering the training device displays and controls, described on p. A-15 above.

(5) Commonality Analyses

You use this option to enter the commonality between the lists of tasks and subtasks to be trained on the training device and the tasks and subtasks comprising the operational performance objectives. DEFT will display each task or subtask you entered as part of the operational objective and ask you to indicate whether or not each is represented in the training device.

When you select this option, the following appears on the screen:

Commonality Analysis

Enter Starting Operational Equipment Task.Subtask number 0000.0000

DEFT will display the titles and numbers of the tasks and subtasks entered previously, starting from the number you enter. Suppose you start with subtask 1.1. Type in 1.1 and hit ENTER. You will see:

(5) Commonality Analysis

Consider descriptions of the subtasks (tasks) that comprise the training objective(s), the subtasks (tasks) that comprise the operational performance objective(s) as well as descriptions of the training device and operational equipment, including their displays and controls.

For each subtask (task) in the operational performance objective(s), enter a "1" if it is represented (simulated) in the training objective(s); enter a "0" if it is not represented (simulated) in the training objective(s).

Task.Subtask = 1.1000 Turn on

Enter Rating = 999

NOTE: "999" means that a rating has not yet been made. If a rating has already been made, the screen will display

Task.Subtask = 1.1000 Turn On

Previous Rating = 1 (or 0) Enter Rating =

Follow the directions: type **1** if this subtask is represented or a **0** if it is not. Hit ENTER and DEFT will move to the next task or subtask. Continue until you have entered a number for all tasks or subtasks comprising the operational performance objective.

(6) Similarity Matching

You will use this option to "pair up" corresponding displays and controls in the training device and the operational equipment. You will enter the number of a display or control you have previously entered in your Operational

Equipment Controls and Displays data base and the number of the corresponding control or display from your Training Device Controls and Displays data base. You must go through this option in order to conduct a DEFT III analysis.

1. After selecting option 6, you will see:

(6) Similarity Matching

Enter Operational Equipment Task.Subtask 0000.0000

Type in the number of the first subtask in the operational task objective and hit ENTER. Suppose you start by typing **1.1** and hitting **ENTER.**

2. You will now see:

(6) Similarity Matching

Operational Equipment
Task.Subtask = 1.1000
Title = Set Up
Enter Control or Display number

Now type in the number you assigned to the first display or control in this subtask and hit ENTER. Suppose you type in **1** and hit **ENTER.**

3. You will now see:

(6) Similarity Matching

Operational Equipment

Task/Subtask = 1.1000

Title = Set Up

Control/Display = 1.1000.1

Title = Pushbutton

Enter Training Device Task.Subtask number 0000.0000

You now enter the number of the corresponding task or subtask in the training device. Suppose you type in **1.1** and hit ENTER.

4. The screen will now display all of the above information plus the number and title of the training device task or subtask. You will then be asked to **Enter Control or Display number** of the corresponding display or control. Type in that number and hit ENTER.

5. The screen will now show the name and number of the corresponding display and control in the training device. Hit ENTER to store this correspondence.

6. DEFT will then prompt you for any other displays or controls that correspond to those of the operational task or subtask you have selected. When you have completed entering the corresponding displays and controls for a subtask, hit **ESC** to begin another subtask. When you have completed all subtasks, hit **ESC** to return to the Data Base Maintenance menu.

(7) EXIT PROGRAM

Use this option to get out of the MAINT program. Do not just turn off the PC; you must use option 7 to store any entries you have made. Failure to exit from the MAINT program using option 7 will result in the loss of all data entered.

Reviewing and Modifying the Data Bases

You can review, change, and update your data bases easily using the **MAINT** option. To review what you have entered, use the function keys labeled **F1, F2, F3, and F4** on the left-hand side of the keyboard. Whenever the following is displayed on the screen,

Hit 'F1' to List Training Device Tasks and Subtasks

Hit 'F2' to List Operational Equipment Tasks and Subtasks

Hit 'F3' to List Training Device Controls and Displays

Hit 'F4' to List Operational Equipment Controls and Displays

just hit the function key corresponding to the list you want to review.

Example: To review the titles of the training device tasks and subtasks, hit **F1**. DEFT will list the task and subtask titles you have entered. When DEFT finishes displaying your list, you will be returned to wherever you were when you hit F1.

To change or update your data base:

1. use options one through four in the Data Base Maintenance menu to select the data base you want to modify;
2. to add a name or title, just add a number and name or title to the end of your list, using the same procedures as before;
3. to change a name, title, or number, <u>type over</u> the old name with a new one;
4. to delete number and title, type over the old title with "delete". If necessary, space out to the end of the old title.

EXAMPLE: You want to change subtask 1.1 from SET UP to TURN ON. First, select option 1: Training Device - Task and Subtask Maintenance. You will see

(1) Training Device - Task and Subtask Definition

Enter Training Device Task.Subtask number 0000.0000

Type in **1.1** and hit **ENTER**. You will see

Task.Subtask = 1.1000

Title = SET UP

Now type in **TURN ON**. You will be typing over SET UP. If your new title is shorter than the old one, hit the space bar until the end of the old title is completely erased.

You do not have to start at task 1 or subtask 1.1. For example, if you wanted to change the title of subtask 17.37, you could enter that number when you are prompted. DEFT will take you directly to that subtask.

DEFT

After you have completed entering the necessary data bases, you can actually begin conducting an evaluation. While the building of the data bases may have seemed

tedious, part of what you did was to make the actual rating process more efficient. DEFT uses the information you entered to ask you specific questions, while simultaneously presenting the subject of the question. For example, if you are asked to rate the physical similarity of a pair of controls, DEFT will present the corresponding numbers and titles of each.

To begin your analysis:

1. Load DEFT on to the PC (see p. A-6)

2. When you see the **B>** prompt, type in **DEFT** followed by the name of the device you want to evaluate, then hit ENTER.

Example: **B> DEFT ABC** (hit **ENTER**)

3. You will now see the main DEFT menu:

(1) DEFT I

(2) DEFT II

(3) DEFT III

(4) EXIT

Select the option correspnding to the level of analysis you want to conduct. Remember, DEFT I is a global analysis, asking for general judgments about the training

device. DEFT II is more detailed, asking questions about each task or subtask; you can do a DEFT II analysis at either of these levels. DEFT III is the most detailed analysis, where questions are asked at the subtask level. When the number of subtasks becomes too large to process conveniently, DEFT III can instead be conducted at the task level.

4. When you select one of the three DEFT options, you will next see the menu of analyses you will conduct:

DEFT __ (I, II, or III)

(1) Performance Deficit

(2) Learning Difficulty

(3) Quality of Training-Acquisition

(4) Residual Deficit

(5) Residual Learning Difficulty

(6) Physical Similarity

(7) Functional Similarity

(8) Quality of Training-Transfer

(9) Evaluation Summary

Enter Option Number

Conducting an Analysis

The mechanics of conducting any DEFT analysis are straightforward:

1. Select an option.

2. Information will appear on the screen. Read the screen carefully.

3. Do what DEFT asks you to do: "hit any key to continue," "enter ratings," "enter starting task/subtask," etc.

4. When you have completed one option, DEFT will return you to the above menu.

   NOTE: You must complete options one through eight, or else the ninth option, Evaluation Summary, will not compute summary indexes.

5. When you want to stop, return to the main DEFT menu by hitting ESC. You must exit from the main DEFT menu. Do not turn the PC off in the middle of an analysis -- you will lose some of the information you have entered.

Rather than discuss each analysis, we will present some cautions that you should keep in mind while doing all analyses:

1. Read each screen carefully. Sometimes the ratings asked for will not be in the "correct" direction. For example, in the Performances Deficit Analysis, you will be asked,

(1) DEFT 1 - PERFORMANCE DEFICIT

Examine the statement of the training objective(s). Considering what you know about the typical trainee's background, work experience, and prior training, what proportion of the skills and knowledges required in order to meet the training objective(s) will the trainee still have to learn in order to reach criterion proficiency in the training device?

Enter a number from 0 to 100 using the following scale:

---

0 10 20 30 40 50 60 70 80 90 100

0 = None; the trainee can already meet the training objective(s).

100 = All; the trainee has to learn all of the skills and knowledges needed to meet the training objective(s).

Notice that the upper end of the scale means that the trainee must learn all of the skills and knowledges required.

2. The current version of DEFT does not include any built-in safeguards for picking up "out-of-range" values. Thus, if you mistakenly enter "200" on a 100-point scale, DEFT will treat it as a real rating. Again, be careful.

3. Most of the DEFT ratings are on a 0-100 scale. Be careful when you enter a "0" or a "100." When you enter a "0," it does not appear on the screen, although DEFT has recorded your zero. When you enter "100," DEFT will automatically skip to the next screen -- you do not have to hit ENTER. However, if you enter a rating between zero and 99, you must hit ENTER.

LIST

The last major routine you will use is **LIST**, which enables you to review any or all of the ratings you have made. To make it easier for you to review your ratings, DEFT provides you with three options. Thus,

1. Load DEFT into the PC (see p. A-6)

2. When you see the **B>** prompt, type **LIST** followed by the name of the device, and hit ENTER. You will see:

LIST RATINGS

(1) List Training Device Ratings

(2) List Operational Equipment Ratings

(3) List Common Controls and Displays

(4) EXIT PROGRAM

Enter Option Number

The first option will display the ratings you made concerning the training device: Performance Deficit, Learning Difficulty, and Quality of Training - Acquisition. These will be listed by task or subtask, depending upon what you ask for. The second option will display the ratings you made concerning the operational equipment:

Residual Deficit, Residual Learning Difficulty, and Quality of Training - Transfer. The third option will list each pair of displays or controls and its Physical and Functional Similarity ratings.

Using DEFT

In this final section, we will present a few suggestions on how to use DEFT when evaluating a training device. These suggestions are based on our experiences with evaluating training devices, using several different devices and several different raters.

1. Evaluation of a training device should be done by more than one person. We recommend a team approach, where the team consists of at least one person intimately familiar with the performance requirements of the training device and the operational performance requirements, at least one person intimately familiar with the engineering aspects of both the training device and the operational equipment, and at least one person who has a working familiarity with DEFT.

2. We suggest that members of this team meet before individually conducting their own evaluations. During this meeting, it is crucial to discuss and agree upon all

assumptions that will be made regarding various aspects of the training program and operational situation. Consensus must be reached regarding:

a. The background, experiences, and skills and knowledge that trainees will possess upon beginning on the training device;

b. The material contained in the various data bases -- i.e., consensus must be reached regarding the tasks/subtasks contained in the training device and operational situation, the displays and controls used, the commonality of the tasks/subtasks, and the correspondence between the sets of displays and controls used in the training device and operational equipment;

c. The meanings of the various scales and dimensions of DEFT -- the team member(s) familiar with the procedure should walk through DEFT with the other team members, ensuring that everyone agrees as to the meaning of each of the DEFT scales and dimensions.

3. Following this meeting, each team member should evaluate the device independently (at whatever level or

levels of DEFT the team agrees upon). We recommend that evaluators keep notes on each of their ratings. These notes should contain the individual's assumptions and rationale for each judgment.

4. After each team member has evaluated the training device, the team should reconvene to discuss their ratings. Each difference in ratings should be discussed until a consensus is reached; if a consensus cannot be reached, the team should at least agree to a decision rule (e.g., take a mean of the ratings to represent consensus; take the "worst-case" or "best-case" judgments, etc.).

These procedures are important first to ensure that different perspectives are represented during a training device evaluation, second to ensure that everyone is evaluating the "same" device (i.e., with the same set of assumptions), and third to ensure that factual misinterpretations are minimized.

APPENDIX B

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```
 IDENTIFICATION DIVISION.
 PROGRAM-ID.   DEFT0.
*-----------------------------------------------------------------.
*  THIS PROGRAM IS THE DEFT MENU PROGRAM.
*-----------------------------------------------------------------.
 AUTHOR. Timothy OConnor.
 INSTALLATION. American Institutes for Research.
 DATE-WRITTEN.  JULY 1984.
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.
 OBJECT-COMPUTER.
 INPUT-OUTPUT SECTION.
 FILE-CONTROL.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
 01  NOTHING PIC X.
 01  CTL-STATUS-WORD    PIC XX.
 01  DEVICE-STATUS-WORD  PIC XX.
 01  TITLE-STATUS-WORD  PIC XX.
 01  NEW-DESC     PIC X(54).
 01  OPTION      PIC X.
 01  LAST-KEY   PIC XX.

 PROCEDURE DIVISION.
 BEGIN.
     DISPLAY (1, 1) ERASE.
     DISPLAY (1, 22)
             "DEFT MAIN MENU".
     DISPLAY (5, 23)
              "(1) DEFT I".
     DISPLAY (7, 23)
              "(2) DEFT II".
     DISPLAY (9, 23)
              "(3) DEFT III".
     DISPLAY (11, 23)
              "(4) EXIT PROGRAM".
     DISPLAY (14, 14)
     "Enter option   ".
     ACCEPT (LIN, COL) OPTION WITH AUTO-SKIP.
     DISPLAY (1, 1) ERASE.
     IF OPTION = "1"  CALL "DEFT1".
     IF OPTION = "2"  CALL "DEFT2".
     IF OPTION = "3"  CALL "DEFT3".
     IF OPTION = "4"  STOP RUN.
       GO TO BEGIN.
```

```
 IDENTIFICATION DIVISION.
 PROGRAM-ID.   DEFT1.
* ------------------------------------------------------.
* THIS IS THE DEFT I  ANALYSIS PROGRAM.
* ------------------------------------------------------ .
 AUTHOR. Timothy OConnor.
 INSTALLATION. American Institutes for Research.
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.
 OBJECT-COMPUTER.
 INPUT-OUTPUT SECTION.
 FILE-CONTROL.

       SELECT DEVICE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS DEVICE-KEY
            FILE STATUS IS DEVICE-STATUS-WORD.


     SELECT TEXT-FILE ASSIGN TO DISK
             ORGANIZATION IS LINE SEQUENTIAL.

 DATA DIVISION.
 FILE SECTION.
 FD  DEVICE-FILE
        LABEL RECORD IS STANDARD;
        VALUE OF FILE-ID IS "B:DEVICE".
 01  DEVICE-RECORD.
     03 DEVICE-KEY       PIC X(10).
     03 DEVICE-ANALYSIS   OCCURS 20 TIMES PIC 999.
     03 DEVICE-TITLE    PIC X(60).

 FD  TEXT-FILE
         LABEL RECORD IS STANDARD;
         VALUE OF FILE-ID IS "A:DEFT1.DOC".
 01  TEXT-RECORD.
     05 REC-INDICATOR       PIC XX.
     05 FILLER              PIC X.
     05 ANALYSIS-NUMBER     PIC X.
     05 FILLER            PIC X(75).


 WORKING-STORAGE SECTION.
 01  NOTHING PIC X.
 01  TASK-NO  PIC Z(4).9999 DISPLAY.
 01  RATING PIC 999.
 01  PREVIOUS-RATING PIC ZZ9.
 01  DEVICE-STATUS-WORD  PIC XX.
 01  EOF-DEVICE  PIC 9  VALUE 0.
 01  TITLE-STATUS-WORD  PIC XX.
 01  REQ-TASK-NO.
     05 REQ-TYPE  PIC 9.
     05 REQ-TASK    PIC Z(4).
```

```
    05 FILLER  PIC X.
    05 REQ-SUBTASK    PIC X(4).
01  READ-TASK-NO.
    05 READ-TYPE   PIC 9.
    05 READ-TASK1  PIC Z(4).
    05 FILLER  PIC X.
    05 READ-SUBTASK PIC X(4).
01  LAST-KEY    PIC XX.
01  OPTION    PIC 9.
01  PREV-OPTION   PIC 9.
01  X    PIC 9(4).
01  Z    PIC 9(4).
01  I    PIC 9(4).
01  DISPLAY-NUMBER  PIC  ZZ,ZZZ.99.
01  TRAINING-PROBLEM   PIC 9(5)V99.
01  ACQUISITION-EFFICIENCY   PIC 9(5)V99.
01  TRAINING-ACQUISITION  PIC 9(5)V99.
01  TRANSFER-PROBLEM   PIC 9(5)V99.
01  TRANSFER-EFFICIENCY  PIC 9(5)V99.
01  ADDITIONAL-DEFICIT  PIC S9999.
01  TRAINING-TRANSFER   PIC 9(5)V99.
01  DEFT                PIC 9(5)V99.
01  SQR1                PIC S9(9) COMP.
01  SQR-ROOT             PIC 9(5)V99  COMP.
01  J                   PIC 9(9) COMP.


PROCEDURE DIVISION.
BEGIN.
    OPEN I-O DEVICE-FILE.
    OPEN INPUT TEXT-FILE.
    DISPLAY (1, 1) ERASE.
    MOVE "0   0.0000" TO DEVICE-KEY.
    MOVE TASK-NO TO REQ-TASK-NO.
    READ DEVICE-FILE RECORD INVALID KEY GO TO BAD-KEY.
    MOVE 0 TO OPTION.
MENU.
    MOVE OPTION TO PREV-OPTION.
    MOVE 0 TO OPTION.
    MOVE 0 TO EOF-DEVICE
    MOVE "00" TO LAST-KEY
    DISPLAY (1, 1)ERASE.
    DISPLAY (1, 25)
              "        DEFT I                          ".
    DISPLAY (4, 25)
              "(1)  Performance Deficit                ".
    DISPLAY (5, 25)
              "(2)  Learning Difficulty                ".
    DISPLAY (6, 25)
              "(3)  Quality of Training-Acquisition    ".
    DISPLAY (7, 25)
              "(4)  Residual Deficit                   ".
    DISPLAY (8, 25)
              "(5)  Residual Learning Difficulty       ".
    DISPLAY (9, 25)
```

```
                "(6)  Physical Similarity                ".
    DISPLAY (10, 25)
                "(7)  Functional Similarity              ".
    DISPLAY (11, 25)
                "(8)  Quality of Training-Transfer       ".
    DISPLAY (12, 25)
                "(9)  Evaluation Summary                 ".
    DISPLAY (15, 12)"Enter Option Number ".
    ACCEPT (LIN, COL) OPTION WITH AUTO-SKIP.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO STOP-RUN.
    DISPLAY (1, 1)ERASE.
    IF OPTION = 01 GO TO PERFORMANCE-DEFICIT-ANALYSIS.
    IF OPTION = 02 GO TO LEARNING-DIFFICULTY-ANALYSIS.
    IF OPTION = 03 GO TO TRAINING-ACQUISITION-ANALYSIS.
    IF OPTION = 04 GO TO RESIDUAL-DEFICIT-ANALYSIS.
    IF OPTION = 05 GO TO RESIDUAL-DIFFICULTY-ANALYSIS.
    IF OPTION = 06 GO TO PHYSICAL-SIMILARITY-ANALYSIS.
    IF OPTION = 07 GO TO FUNCTIONAL-SIMILARITY-ANALYSIS.
    IF OPTION = 08 GO TO TRAINING-TRANSFER-ANALYSIS.
    IF OPTION = 09 GO TO EVALUATION-SUMMARY.
    IF OPTION = 10 GO TO STOP-RUN.
    GO TO MENU.
PERFORMANCE-DEFICIT-ANALYSIS.
    MOVE 1 TO X.
    MOVE 1 TO Z.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
    GO TO MENU.
LEARNING-DIFFICULTY-ANALYSIS.
    MOVE 2 TO X.
    MOVE 2 TO Z.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
    GO TO MENU.
TRAINING-ACQUISITION-ANALYSIS.
    MOVE 3 TO X.
    MOVE 3 TO Z.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
    GO TO MENU.
RESIDUAL-DEFICIT-ANALYSIS.
    MOVE 4 TO X.
    MOVE 4 TO Z.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
    GO TO MENU.
RESIDUAL-DIFFICULTY-ANALYSIS.
    MOVE 5 TO X.
    MOVE 5 TO Z.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
```

```
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
    GO TO MENU.
PHYSICAL-SIMILARITY-ANALYSIS.
    MOVE 6 TO X.
    MOVE 6 TO Z.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
    GO TO MENU.
FUNCTIONAL-SIMILARITY-ANALYSIS.
    MOVE 7 TO X.
    MOVE 7 TO Z.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
    GO TO MENU.
TRAINING-TRANSFER-ANALYSIS.
    MOVE 8 TO X.
    MOVE 8 TO Z.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
    GO TO MENU.
FIND-SCREEN.
    IF ANALYSIS-NUMBER > OPTION OR OPTION = PREV-OPTION
       CLOSE TEXT-FILE
       OPEN INPUT TEXT-FILE
       READ TFXT-FILE RECORD AT END GO TO EOF-TEXT.
    DISPLAY (1, 1) ERASE.
READ-TEXT.
    IF REC-INDICATOR = "ZZ" AND
      ANALYSIS-NUMBER = OPTION GO TO DISPLAY-SCREEN.
    IF REC-INDICATOR = "ZQ" AND ANALYSIS-NUMBER = OPTION
        PERFORM DISPLAY-INTRO-SCREEN THRU
                DISPLAY-INTRO-SCREEN-EXIT
        PERFORM HIT-ANY-KEY
        GO TO READ-TEXT.
    READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    GO TO READ-TEXT.
DISPLAY-SCREEN.
    IF LAST-KEY = "01" GO TO DISPLAY-SCREEN-EXIT.
    READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    IF REC-INDICATOR = "ZZ" OR REC-INDICATOR = "ZQ"
      GO TO DISPLAY-SCREEN-EXIT.
    DISPLAY TEXT-RECORD.
    GO TO DISPLAY-SCREEN.
DISPLAY-SCREEN-EXIT.
    EXIT.
HIT-ANY-KEY.
    DISPLAY (LIN, COL) "Hit any key to continue ".
    ACCEPT (LIN, COL) NOTHING WITH AUTO-SKIP.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    DISPLAY(1, 1)ERASE.
RATE-TASKS.
```

```
    DISPLAY (23 , 1)ERASE.
    DISPLAY (LIN, 1) DEVICE-TITLE.
    DISPLAY " ".
    MOVE DEVICE-ANALYSIS(X) TO RATING.
    IF RATING NOT = 999
      MOVE RATING TO PREVIOUS-RATING
      DISPLAY (LIN, 1) "Previous Rating = ", PREVIOUS-RATING.
    DISPLAY (LIN, COL) "    Enter Rating = "
    ACCEPT (LIN, COL) RATING WITH AUTO-SKIP UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO RATE-TASKS-EXIT.
    IF RATING = PREVIOUS-RATING GO TO RATE-TASKS-EXIT.
    MOVE RATING TO DEVICE-ANALYSIS(X).
    REWRITE DEVICE-RECORD INVALID KEY GO TO BAD-KEY.
RATE-TASKS-EXIT.
    EXIT.
EVALUATION-SUMMARY.
    DISPLAY (1, 1)ERASE.
    DISPLAY (1, 31) "Evaluation Summary".
    DISPLAY (3, 1)
                "     Performance Deficit                ".
    MOVE DEVICE-ANALYSIS(1) TO PREVIOUS-RATING.
    IF PREVIOUS-RATING NOT = 999
     DISPLAY (LIN, COL) PREVIOUS-RATING.
    DISPLAY (4, 1)
                "     Learning Difficulty                ".
    MOVE DEVICE-ANALYSIS(2) TO PREVIOUS-RATING.
    IF PREVIOUS-RATING NOT = 999
     DISPLAY (LIN, COL) PREVIOUS-RATING.
    DISPLAY (5, 1)
                "          Training Problem                ".
    MOVE 999 TO TRAINING-PROBLEM.
    IF DEVICE-ANALYSIS(1) NOT = 999 AND
       DEVICE-ANALYSIS(2) NOT = 999
       COMPUTE TRAINING-PROBLEM ROUNDED =
        (DEVICE-ANALYSIS(1) * DEVICE-ANALYSIS(2)) / 100
       MOVE TRAINING-PROBLEM TO DISPLAY-NUMBER
       DISPLAY (LIN, COL) DISPLAY-NUMBER.
    DISPLAY (6, 1)
                "     Quality of Training-Acquisition   ".
    MOVE DEVICE-ANALYSIS(3) TO PREVIOUS-RATING.
    IF PREVIOUS-RATING NOT = 999
     DISPLAY (LIN, COL) PREVIOUS-RATING.
    DISPLAY (7, 1)
                "          Acquisition-Efficiency          ".
    MOVE 999 TO ACQUISITION-EFFICIENCY.
    IF DEVICE-ANALYSIS(3) NOT = 999
      COMPUTE ACQUISITION-EFFICIENCY ROUNDED =
       (DEVICE-ANALYSIS(3) / 100)
      MOVE ACQUISITION-EFFICIENCY TO SQR-ROOT
      PERFORM SQUARE-ROOT
      MOVE SQR-ROOT TO ACQUISITION-EFFICIENCY
      MOVE ACQUISITION-EFFICIENCY TO DISPLAY-NUMBER
      DISPLAY(LIN, COL) DISPLAY-NUMBER.
    DISPLAY (8, 10)
```

```
           "          Acquisition                          ".
IF ACQUISITION-EFFICIENCY = 0
  MOVE .01 TO ACQUISITION-EFFICIENCY.
MOVE 999 TO TRAINING-ACQUISITION.
IF TRAINING-PROBLEM NOT = 999 AND
   ACQUISITION-EFFICIENCY NOT = 999
   COMPUTE TRAINING-ACQUISITION ROUNDED =
   TRAINING-PROBLEM / ACQUISITION-EFFICIENCY
   MOVE TRAINING-ACQUISITION TO DISPLAY-NUMBER
   DISPLAY(LIN, COL) DISPLAY-NUMBER.
DISPLAY (9, 1)
           "     Residual Deficit                        ".
MOVE DEVICE-ANALYSIS(4) TO PREVIOUS-RATING.
IF PREVIOUS-RATING NOT = 999
 DISPLAY (LIN, COL) PREVIOUS-RATING.
DISPLAY (10, 1)
           "     Residual Learning Difficulty            ".
MOVE DEVICE-ANALYSIS(5) TO PREVIOUS-RATING.
IF PREVIOUS-RATING NOT = 999
 DISPLAY (LIN, COL) PREVIOUS-RATING.
DISPLAY (11, 1)
           "     Physical Similarity                     ".
MOVE DEVICE-ANALYSIS(6) TO PREVIOUS-RATING.
IF PREVIOUS-RATING NOT = 999
 DISPLAY (LIN, COL) PREVIOUS-RATING.
DISPLAY (12, 1)
           "     Functional Similarity                   ".
MOVE DEVICE-ANALYSIS(7) TO PREVIOUS-RATING.
IF PREVIOUS-RATING NOT = 999
 DISPLAY (LIN, COL) PREVIOUS-RATING.
DISPLAY (13, 1)
           "          Transfer Problem                   ".
MOVE 999 TO TRANSFER-PROBLEM.
MOVE 0 TO ADDITIONAL-DEFICIT.
IF DEVICE-ANALYSIS(6) NOT = 999 AND
  DEVICE-ANALYSIS(7) NOT = 999
   COMPUTE ADDITIONAL-DEFICIT =
    DEVICE-ANALYSIS(6) - DEVICE-ANALYSIS(7).
IF DEVICE-ANALYSIS(7) > DEVICE-ANALYSIS(6)
     MOVE 0 TO ADDITIONAL-DEFICIT.
IF DEVICE-ANALYSIS(4) NOT = 999 AND
   DEVICE-ANALYSIS(5) NOT = 999
   COMPUTE TRANSFER-PROBLEM ROUNDED =
    ((DEVICE-ANALYSIS(4) * DEVICE-ANALYSIS(5)) / 100) +
       ADDITIONAL-DEFICIT
   MOVE TRANSFER-PROBLEM TO DISPLAY-NUMBER
   DISPLAY (LIN, COL) DISPLAY-NUMBER.
DISPLAY (14, 1)
           "     Quality of Training-Transfer            ".
MOVE DEVICE-ANALYSIS(8) TO PREVIOUS-RATING.
IF PREVIOUS-RATING NOT = 999
 DISPLAY (LIN, COL) PREVIOUS-RATING.
DISPLAY (15, 1)
           "          Transfer Efficiency                ".
MOVE 999 TO TRANSFER-EFFICIENCY.
```

```
    IF DEVICE-ANALYSIS(8) NOT = 999
      COMPUTE TRANSFER-EFFICIENCY ROUNDED =
       (DEVICE-ANALYSIS(8) / 100)
      MOVE TRANSFER-EFFICIENCY TO SQR-ROOT
      PERFORM SQUARE-ROOT
      MOVE SQR-ROOT TO TRANSFER-EFFICIENCY
      MOVE TRANSFER-EFFICIENCY TO DISPLAY-NUMBER
      DISPLAY(LIN, COL) DISPLAY-NUMBER.
    DISPLAY (16, 10)
                "          Transfer                                    ".
    IF TRANSFER-EFFICIENCY = 0
      MOVE .01 TO TRANSFER-EFFICIENCY.
    MOVE 999 TO TRAINING-TRANSFER.
    IF TRANSFER-PROBLEM NOT = 999 AND
       TRANSFER-EFFICIENCY NOT = 999
       COMPUTE TRAINING-TRANSFER ROUNDED =
       TRANSFER-PROBLEM / TRANSFER-EFFICIENCY
       MOVE TRAINING-TRANSFER TO DISPLAY-NUMBER
       DISPLAY(LIN, COL) DISPLAY-NUMBER.
    DISPLAY (18, 10)
                "              d                                       ".
    IF TRAINING-ACQUISITION NOT = 999 AND
       TRAINING-TRANSFER NOT = 999
       COMPUTE DEFT = TRAINING-ACQUISITION +
                      TRAINING-TRANSFER
       MOVE DEFT TO DISPLAY-NUMBER
       DISPLAY (LIN, COL) DISPLAY-NUMBER.
    DISPLAY (20, 5)ERASE.
    PERFORM HIT-ANY-KEY.
    GO TO MENU.
STOP-RUN.
    DISPLAY(1, 1)ERASE.
    CLOSE DEVICE-FILE.
    CLOSE TEXT-FILE.
    EXIT PROGRAM.
STOPPER.
    STOP RUN.
EOF-TEXT.
    DISPLAY "EOF ON TEXT FILE".
    STOP RUN.
BAD-KEY.
    DISPLAY "INVALID KEY ", DEVICE-KEY.
    STOP RUN.
TIMER.
    PERFORM NO-OP 2000 TIMES.
NO-OP.
    EXIT.
DISPLAY-INTRO-SCREEN.
    READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    IF REC-INDICATOR = "ZZ" OR REC-INDICATOR = "ZQ"
      GO TO DISPLAY-INTRO-SCREEN-EXIT.
    DISPLAY TEXT-RECORD.
    GO TO DISPLAY-INTRO-SCREEN.
DISPLAY-INTRO-SCREEN-EXIT.
    EXIT.
```

```
SQUARE-ROOT.
    COMPUTE SQR1 = SQR-ROOT * 10000.
    PERFORM SQR-PROC VARYING J FROM 1 BY 2 UNTIL SQR1 < 0.
    COMPUTE SQR-ROOT ROUNDED = (J - 3) / 200.
SQR-PROC.
    SUBTRACT J FROM SQR1.
```

```
 IDENTIFICATION DIVISION.
 PROGRAM-ID.   DEFT2.
*-------------------------------------------------.
* THIS IS THE DEFT II  ANALYSIS PROGRAM
*-------------------------------------------------.
 AUTHOR. Timothy OConnor.
 INSTALLATION. American Institutes for Research.
 DATE-WRITTEN.  AUG 1984.
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.
 OBJECT-COMPUTER.
 INPUT-OUTPUT SECTION.
 FILE-CONTROL.

       SELECT DEVICE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS DEVICE-KEY
            FILE STATUS IS DEVICE-STATUS-WORD.

      SELECT TITLE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS TITLE-KEY
            FILE STATUS IS TITLE-STATUS-WORD.

     SELECT TEXT-FILE ASSIGN TO DISK
             ORGANIZATION IS LINE SEQUENTIAL.

 DATA DIVISION.
 FILE SECTION.
 FD  DEVICE-FILE
        LABEL RECORD IS STANDARD;
        VALUE OF FILE-ID IS "B:DEVICE".
 01  DEVICE-RECORD.
     05 DEVICE-KEY   PIC X(10).
     05 DEVICE-ANALYSIS OCCURS 20 TIMES PIC 999.
     05 DEVICE-TITLE   PIC X(60).

 FD  TEXT-FILE
         LABEL RECORD IS STANDARD;
         VALUE OF FILE-ID IS "A:DEFT2.DOC".
 01  TEXT-RECORD.
     05 REC-INDICATOR      PIC XX.
     05 FILLER             PIC X.
     05 ANALYSIS-NUMBER    PIC X.
     05 FILLER           PIC X(75).

 FD  TITLE-FILE
         LABEL RECORD IS STANDARD;
         VALUE OF FILE-ID IS "B:TITLE".
 01  TITLE-RECORD.
     05 TITLE-KEY.
       07 TITLE-TYPE     PIC 9.
```

```
      07 TITLE-TASK      PIC X(9).
      07 TITLE-PERIOD    PIC X.
      07 TITLE-CONTROL   PIC X(9).
    05 TITLE-DESC        PIC X(60).

WORKING-STORAGE SECTION.
01  ANSWER PIC X.
01  NOTHING PIC X.
01  TITLE-FLAG  PIC S9(4) COMP VALUE 0.
01  TASK-NO  PIC Z(3)9.9999 DISPLAY.
01  RATING PIC 999.
01  PREVIOUS-RATING PIC ZZ9.
01  TITLE-STATUS-WORD  PIC XX.
01  DEVICE-STATUS-WORD  PIC XX.
01  EOF-DEVICE  PIC 9  VALUE 0.
01  REQ-TASK-NO.
    05 REQ-TYPE  PIC 9.
    05 REQ-TASK    PIC Z(4).
    05 FILLER  PIC X.
    05 REQ-SUBTASK    PIC X(4).
01  READ-TASK-NO.
    05 READ-TYPE  PIC 9.
    05 READ-TASK1  PIC Z(4).
    05 FILLER  PIC X.
    05 READ-SUBTASK PIC X(4).
01  TASK-KEY.
    05 TYPE-PART  PIC X.
    05 TASK-PART  PIC X(9).
    05 PERIOD-PART PIC X VALUE ".".
    05 CONTROL-PART PIC X(9).
01  OPTION      PIC 9.
01  PREV-OPTION      PIC 9.
01  LAST-KEY    PIC XX.
01  X    PIC 9(4).
01  Q    PIC 9(4).
01  Z    PIC 9(4).
01  K    PIC 9(4).
01  I    PIC 9(4).
01  DISPLAY-NUMBER  PIC  ZZ,ZZZ.99.
01  TRAINING-PROBLEM   PIC 9(5)V99.
01  ACQUISITION-EFFICIENCY   PIC 9(5)V99.
01  TRAINING-ACQUISITION  PIC 9(5)V99.
01  TRANSFER-PROBLEM   PIC 9(5)V99.
01  TRANSFER-EFFICIENCY  PIC 9(5)V99.
01  ADDITIONAL-DEFICIT  PIC S9999.
01  TRAINING-TRANSFER   PIC 9(5)V99.
01  DEFT PIC 9(5)V99.
01  N1 PIC 9(4).
01  N2 PIC 9(4).
01  N3 PIC 9(4).
01  TP-PRODUCT PIC 9(8).
01  RD-PRODUCT PIC 9(8).
01  PS-FS PIC 9(8).
01  SQR1                PIC S9(9) COMP.
01  SQR-ROOT             PIC 9(5)V99  COMP.
```

```
01  J                       PIC 9(9) COMP.

PROCEDURE DIVISION.
BEGIN.
    OPEN I-O DEVICE-FILE.
    OPEN INPUT TEXT-FILE.
    OPEN INPUT TITLE-FILE.
    DISPLAY (1, 1) ERASE.
    MOVE ZEROS TO TASK-NO.
    MOVE TASK-NO TO REQ-TASK-NO.
    MOVE 0 TO OPTION.
MENU.
    MOVE OPTION TO PREV-OPTION.
    MOVE 0 TO OPTION.
    MOVE 0 TO EOF-DEVICE.
    MOVE "00" TO LAST-KEY
    DISPLAY (1, 1)ERASE.
    DISPLAY (1, 25)
                "          DEFT II                          ".
    DISPLAY (4, 25)
                "(1)  Performance Deficit                   ".
    DISPLAY (5, 25)
                "(2)  Learning Difficulty                   ".
    DISPLAY (6, 25)
                "(3)  Quality of Training-Acquisition       ".
    DISPLAY (7, 25)
                "(4)  Residual Deficit                      ".
    DISPLAY (8, 25)
                "(5)  Residual Learning Difficulty          ".
    DISPLAY (9, 25)
                "(6)  Physical Similarity                   ".
    DISPLAY (10, 25)
                "(7)  Functional Similarity                 ".
    DISPLAY (11, 25)
                "(8)  Quality of Training-Transfer          ".
    DISPLAY (12, 25)
                "(9)  Evaluation Summary                    ".
    DISPLAY (15, 12)"Enter Option Number ".
    ACCEPT (LIN, COL) OPTION WITH AUTO-SKIP.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO STOP-RUN.
    DISPLAY (1, 1)ERASE.
    IF OPTION = 1 GO TO PERFORMANCE-DEFICIT-ANALYSIS.
    IF OPTION = 2 GO TO LEARNING-DIFFICULTY-ANALYSIS.
    IF OPTION = 3 GO TO TRAINING-ACQUISITION-ANALYSIS.
    IF OPTION = 4 GO TO RESIDUAL-DEFICIT-ANALYSIS.
    IF OPTION = 5 GO TO RESIDUAL-DIFFICULTY-ANALYSIS.
    IF OPTION = 6 GO TO PHYSICAL-SIMILARITY-ANALYSIS.
    IF OPTION = 7 GO TO FUNCTIONAL-SIMILARITY-ANALYSIS.
    IF OPTION = 8 GO TO TRAINING-TRANSFER-ANALYSIS.
    IF OPTION = 9 GO TO EVALUATION-SUMMARY.
    GO TO MENU.
PERFORMANCE-DEFICIT-ANALYSIS.
    MOVE 0 TO TYPE-PART.
    MOVE 1 TO X.
```

```
    MOVE 1 TO Z.
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT  VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
LEARNING-DIFFICULTY-ANALYSIS.
    MOVE 0 TO TYPE-PART.
    MOVE 2 TO X.
    MOVE 2 TO Z
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
TRAINING-ACQUISITION-ANALYSIS.
    MOVE 0 TO TYPE-PART.
    MOVE 9 TO X.
    MOVE 12 TO Z
    MOVE "0   0.0000" TO DEVICE-KEY.
    MOVE DEVICE-KEY TO REQ-TASK-NO.
    MOVE DEVICE-KEY TO TASK-KEY.
    START DEVICE-FILE KEY IS EQUAL TO DEVICE-KEY
          INVALID KEY GO TO BAD-KEY.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
    GO TO MENU.
RESIDUAL-DEFICIT-ANALYSIS.
    MOVE 1 TO TYPE-PART.
    MOVE 1 TO X.
    MOVE 1 TO Z
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
RESIDUAL-DIFFICULTY-ANALYSIS.
    MOVE 1 TO TYPE-PART.
    MOVE 2 TO X.
    MOVE 2 TO Z
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
PHYSICAL-SIMILARITY-ANALYSIS.
    MOVE 1 TO TYPE-PART.
    MOVE 3 TO X.
```

```
    MOVE 3 TO Z
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
FUNCTIONAL-SIMILARITY-ANALYSIS.
    MOVE 1 TO TYPE-PART.
    MOVE 4 TO X.
    MOVE 4 TO Z
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
TRAINING-TRANSFER-ANALYSIS.
    MOVE 0 TO TYPE-PART.
    MOVE 13 TO X.
    MOVE 15 TO Z
    MOVE "0   0.0000" TO DEVICE-KEY.
    MOVE DEVICE-KEY TO REQ-TASK-NO.
    MOVE DEVICE-KEY TO TASK-KEY.
    START DEVICE-FILE KEY IS EQUAL TO DEVICE-KEY
          INVALID KEY GO TO BAD-KEY.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT.
    GO TO MENU.
EVALUATION-SUMMARY.
    DISPLAY (1, 1)ERASE.
    DISPLAY (2, 5) "Evaluate by (T)ask or (S)ubtask ? ".
    MOVE SPACES TO ANSWER.
    MOVE "0000" TO REQ-SUBTASK.
    ACCEPT (LIN, COL) ANSWER WITH AUTO-SKIP.
    IF ANSWER = "S" OR ANSWER = "s" MOVE "9999" TO REQ-SUBTASK.
    MOVE 0 TO TRAINING-PROBLEM.
    MOVE 0 TO TRAINING-ACQUISITION.
    MOVE 0 TO TRANSFER-PROBLEM.
    MOVE 0 TO ADDITIONAL-DEFICIT.
    MOVE 0 TO TRAINING-TRANSFER.
    MOVE 0 TO DEFT.
    MOVE 0 TO N1.
    MOVE 0 TO N2.
    MOVE 0 TO N3.
    MOVE 0 TO TP-PRODUCT.
    MOVE 0 TO RD-PRODUCT.
    MOVE 0 TO PS-FS.
    MOVE "0   0.0000" TO DEVICE-KEY.
    READ DEVICE-FILE RECORD INVALID KEY GO TO BAD-KEY.
    MOVE 999 TO ACQUISITION-EFFICIENCY.
    IF DEVICE-ANALYSIS(9) NOT = 999 AND
       DEVICE-ANALYSIS(10) NOT = 999 AND
       DEVICE-ANALYSIS(11) NOT = 999 AND
```

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   DEVICE-ANALYSIS(12) NOT = 999
   COMPUTE ACQUISITION-EFFICIENCY ROUNDED =
    ((DEVICE-ANALYSIS(9) + DEVICE-ANALYSIS(10) +
   DEVICE-ANALYSIS(11) + DEVICE-ANALYSIS(12)) / 400)   .
MOVE 999 TO TRANSFER-EFFICIENCY.
IF DEVICE-ANALYSIS(13) NOT = 999 AND
   DEVICE-ANALYSIS(14) NOT = 999 AND
   DEVICE-ANALYSIS(15) NOT = 999
   COMPUTE TRANSFER-EFFICIENCY ROUNDED =
    ((DEVICE-ANALYSIS(13) + DEVICE-ANALYSIS(14) +
    DEVICE-ANALYSIS(15)) / 300)   .
PERFORM SUM-TASK THRU SUM-TASK-EXIT VARYING I FROM 1 BY 1
  UNTIL EOF-DEVICE = 1.
DISPLAY (1, 1)ERASE.
DISPLAY (1, 31) "Evaluation Summary".
DISPLAY (3, 1)
           "              Training Problem                  ".
IF N1 NOT = 0
 COMPUTE TRAINING-PROBLEM ROUNDED = TP-PRODUCT / (N1 * 100)
 MOVE TRAINING-PROBLEM TO DISPLAY-NUMBER
 DISPLAY (LIN, COL) DISPLAY-NUMBER.
DISPLAY (5, 1)
           "              Acquisition-Efficiency            ".
IF ACQUISITION-EFFICIENCY NOT = 999
  MOVE ACQUISITION-EFFICIENCY TO SQR-ROOT
  PERFORM SQUARE-ROOT
  MOVE SQR-ROOT TO ACQUISITION-EFFICIENCY
  MOVE ACQUISITION-EFFICIENCY TO DISPLAY-NUMBER
  DISPLAY(LIN, COL) DISPLAY-NUMBER.
DISPLAY (7, 10)
           "              Acquisition                       ".
IF ACQUISITION-EFFICIENCY = 0
     MOVE .01 TO ACQUISITION-EFFICIENCY.
IF ACQUISITION-EFFICIENCY NOT = 999
  COMPUTE TRAINING-ACQUISITION ROUNDED =
   TRAINING-PROBLEM / ACQUISITION-EFFICIENCY
  MOVE TRAINING-ACQUISITION TO DISPLAY-NUMBER
  DISPLAY(LIN, COL) DISPLAY-NUMBER.
DISPLAY (9, 1)
           "              Transfer Problem                  ".
IF N3 NOT = 0
  COMPUTE ADDITIONAL-DEFICIT ROUNDED =
    PS-FS / N3.
IF N2 NOT = 0
  COMPUTE TRANSFER-PROBLEM ROUNDED =
    (RD-PRODUCT / N2) +  ADDITIONAL-DEFICIT
  MOVE TRANSFER-PROBLEM TO DISPLAY-NUMBER
  DISPLAY (LIN, COL) DISPLAY-NUMBER.
DISPLAY (11, 1)
           "              Transfer Efficiency               ".
IF TRANSFER-EFFICIENCY NOT = 999
  MOVE TRANSFER-EFFICIENCY TO SQR-ROOT
  PERFORM SQUARE-ROOT
  MOVE SQR-ROOT TO TRANSFER-EFFICIENCY
  MOVE TRANSFER-EFFICIENCY TO DISPLAY-NUMBER
```

```
      DISPLAY(LIN, COL) DISPLAY-NUMBER.
    DISPLAY (13, 10)
                "          Transfer                                    ".
    IF TRANSFER-EFFICIENCY = 0
         MOVE .01 TO TRANSFER-EFFICIENCY.
    IF TRANSFER-EFFICIENCY NOT = 999
      COMPUTE TRAINING-TRANSFER ROUNDED =
         TRANSFER-PROBLEM / TRANSFER-EFFICIENCY
      MOVE TRAINING-TRANSFER TO DISPLAY-NUMBER
      DISPLAY(LIN, COL) DISPLAY-NUMBER.
    DISPLAY (16, 10)
                "                    d                                 ".
    COMPUTE DEFT = TRAINING-ACQUISITION +
                        TRAINING-TRANSFER.
    MOVE DEFT TO DISPLAY-NUMBER.
    DISPLAY (LIN, COL) DISPLAY-NUMBER.
    DISPLAY (20, 5)ERASE.
    PERFORM HIT-ANY-KEY.
    GO TO MENU.
EVALUATION-SUMMARY-EXIT.
    EXIT.
FIND-SCREEN.
    IF ANALYSIS-NUMBER > OPTION OR OPTION = PREV-OPTION
       CLOSE TEXT-FILE
       OPEN INPUT TEXT-FILE
       MOVE 0 TO PREV-OPTION
       READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    DISPLAY (1, 1) ERASE.
READ-TEXT.
    IF REC-INDICATOR = "ZZ" AND
      ANALYSIS-NUMBER = OPTION GO TO DISPLAY-SCREEN.
    IF REC-INDICATOR = "ZQ" AND ANALYSIS-NUMBER = OPTION
        PERFORM DISPLAY-INTRO-SCREEN THRU
                DISPLAY-INTRO-SCREEN-EXIT
        PERFORM HIT-ANY-KEY
        GO TO DISPLAY-SCREEN.
    READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    GO TO READ-TEXT.
DISPLAY-SCREEN.
    IF LAST-KEY = "01" GO TO DISPLAY-SCREEN-EXIT.
    READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    IF REC-INDICATOR = "ZZ" OR REC-INDICATOR = "ZQ"
      GO TO DISPLAY-SCREEN-EXIT.
    DISPLAY TEXT-RECORD.
    GO TO DISPLAY-SCREEN.
DISPLAY-SCREEN-EXIT.
    EXIT.
HIT-ANY-KEY.
    DISPLAY (LIN, COL) "Hit any key to continue ".
    ACCEPT (LIN, COL) NOTHING WITH AUTO-SKIP.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    DISPLAY(1, 1)ERASE.
FIND-STARTING-TASK.
    DISPLAY (5, 1)ERASE.
    MOVE ZEROS TO TASK-NO.
```

```
    DISPLAY (22, 5)
     "Hit 'F1' to List Training Device Tasks & Subtasks".
    DISPLAY (23, 5)
     "Hit 'F2' to List Operational Equipment Tasks & Subtasks".
    DISPLAY (24, 5)
     "Hit 'F3' to List Training Device Controls & Displays".
    DISPLAY (25, 5)
     "Hit 'F4' to List Operational Equipment ",
           "Controls & Displays".
    IF OPTION < 4
     MOVE 0 TO TYPE-PART
     DISPLAY (5, 1)
     "Enter Starting Training Device Task.Subtask number  "
    ELSE IF OPTION < 9
         MOVE 1 TO TYPE-PART
         DISPLAY (5, 1)
         "Enter Starting Operational Equipment Task.Subtask ",
         "number  ".
    ACCEPT (LIN, COL) TASK-NO WITH AUTO-SKIP PROMPT.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    MOVE TASK-NO TO TASK-PART.
    IF LAST-KEY = "02" OR LAST-KEY = "03" OR
       LAST-KEY = "04" OR LAST-KEY = "05"
      PERFORM DISPLAY-TASKS THRU DISPLAY-TASKS-END
      GO TO FIND-STARTING-TASK.
    IF LAST-KEY NOT = "01"
     MOVE TASK-NO TO TASK-PART
     MOVE TASK-KEY TO REQ-TASK-NO
     MOVE TASK-KEY TO DEVICE-KEY
     START DEVICE-FILE KEY IS EQUAL TO DEVICE-KEY
               INVALID KEY
                   DISPLAY (LIN, 1) ERASE
                   DISPLAY (LIN, 1)
                   "TASK.SUBTASK NOT FOUND IN DATA BASE "
                   PERFORM TIMER
                   GO TO FIND-STARTING-TASK.
    DISPLAY (1, 1)ERASE.
READ-TASK.
    MOVE 0 TO EOF-DEVICE.
    READ DEVICE-FILE NEXT RECORD AT END MOVE 1 TO EOF-DEVICE
          GO TO READ-TASK-EXIT.
    MOVE DEVICE-KEY TO READ-TASK-NO.
    MOVE DEVICE-KEY TO TASK-KEY.
    IF TASK-PART = "   0.0000" AND OPTION NOT = 3 AND
      OPTION NOT = 8 GO TO READ-TASK.
    IF REQ-SUBTASK = "0000" AND READ-SUBTASK NOT = "0000"
      GO TO READ-TASK.
    IF REQ-SUBTASK NOT = "0000" AND READ-SUBTASK = "0000"
      GO TO READ-TASK.
    IF REQ-TYPE NOT = READ-TYPE GO TO READ-TASK.
    IF OPTION = 2  AND
        DEVICE-ANALYSIS(1) = 0  GO TO READ-TASK.
    IF (OPTION = 5 OR OPTION = 6 OR OPTION = 7) AND
       DEVICE-ANALYSIS(1) < 3 GO TO READ-TASK.
READ-TASK-EXIT.
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```
    EXIT.
RATE-TASKS.
    PERFORM READ-TASK THRU READ-TASK-EXIT.
    IF EOF-DEVICE = 1 GO TO RATE-TASKS-EXIT.
    PERFORM RATE-EACH-TASK THRU RATE-EACH-TASK-EXIT
      VARYING K FROM X BY 1 UNTIL K > Z  OR  LAST-KEY = "01".
    IF LAST-KEY = "01" GO TO RATE-TASKS-EXIT.
RATE-TASKS-EXIT.
    EXIT.
RATE-EACH-TASK.
    IF X NOT = Z
      DISPLAY (1, 1) ERASE
      PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO RATE-EACH-TASK-EXIT.
    DISPLAY (23 , 1)ERASE.
    DISPLAY (LIN, 1) "Task.Subtask = ", TASK-PART, " ",
              DEVICE-TITLE
    MOVE DEVICE-ANALYSIS(K) TO RATING.
    IF RATING NOT = 999
      MOVE RATING TO PREVIOUS-RATING
      DISPLAY (LIN, 1) "Previous Rating = ", PREVIOUS-RATING.
    DISPLAY (LIN, COL) "    Enter Rating = "
    ACCEPT (LIN, COL) RATING WITH AUTO-SKIP UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO RATE-EACH-TASK-EXIT.
    IF RATING = PREVIOUS-RATING GO TO RATE-EACH-TASK-EXIT.
    MOVE RATING TO DEVICE-ANALYSIS(K).
    REWRITE DEVICE-RECORD INVALID KEY GO TO BAD-KEY.
RATE-EACH-TASK-EXIT.
    EXIT.
SUM-TASK.
    MOVE 0 TO EOF-DEVICE.
    READ DEVICE-FILE NEXT RECORD AT END MOVE 1 TO EOF-DEVICE
          GO TO SUM-TASK-EXIT.
    MOVE DEVICE-KEY TO READ-TASK-NO.
    MOVE DEVICE-KEY TO TASK-KEY.
    IF REQ-SUBTASK = "0000" AND READ-SUBTASK NOT = "0000"
      GO TO SUM-TASK.
    IF REQ-SUBTASK NOT = "0000" AND READ-SUBTASK = "0000"
      GO TO SUM-TASK.
    IF TYPE-PART = 1 GO TO SUM-ACTUAL.
SUM-TRAINING-DEVICE.
    IF DEVICE-ANALYSIS(1) = 0 ADD 1 TO N1
         GO TO SUM-ACTUAL.
    IF DEVICE-ANALYSIS(2) NOT = 999
       ADD 1 TO N1
       COMPUTE TP-PRODUCT ROUNDED = TP-PRODUCT +
        (DEVICE-ANALYSIS(1) * DEVICE-ANALYSIS(2)).
    GO TO SUM-TASK-EXIT.
SUM-ACTUAL.
    IF DEVICE-ANALYSIS(1) < 3  ADD 1 TO N2
          GO TO SUM-TASK-EXIT.
    IF DEVICE-ANALYSIS(2) NOT = 999
      ADD 1 TO N2
       COMPUTE RD-PRODUCT ROUNDED = RD-PRODUCT +
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        (1 * DEVICE-ANALYSIS(2))
       IF DEVICE-ANALYSIS(3) NOT = 999 AND
        DEVICE-ANALYSIS(4) NOT = 999
        ADD 1 TO N3
        IF DEVICE-ANALYSIS(3) > DEVICE-ANALYSIS(4)
         COMPUTE PS-FS = PS-FS +
         (DEVICE-ANALYSIS(3) - DEVICE-ANALYSIS(4)).
SUM-TASK-EXIT.
    EXIT.
STOP-RUN.
    DISPLAY(1, 1)ERASE.
    CLOSE DEVICE-FILE.
    CLOSE TITLE-FILE.
    CLOSE TEXT-FILE.
    EXIT PROGRAM.
STOPPER.
    STOP RUN.
EOF-TEXT.
    DISPLAY "EOF ON TEXT FILE".
    STOP RUN.
BAD-KEY.
    DISPLAY "INVALID KEY ", DEVICE-KEY.
    STOP RUN.
TIMER.
    PERFORM NO-OP 2000 TIMES.
NO-OP.
    EXIT.
DISPLAY-INTRO-SCREEN.
    READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    IF REC-INDICATOR = "ZZ" OR REC-INDICATOR = "ZQ"
      GO TO DISPLAY-INTRO-SCREEN-EXIT.
    DISPLAY TEXT-RECORD.
    GO TO DISPLAY-INTRO-SCREEN.
DISPLAY-INTRO-SCREEN-EXIT.
    EXIT.
DISPLAY-TASKS.
    MOVE 0 TO TYPE-PART.
    IF LAST-KEY = "03" OR LAST-KEY = "05"
      MOVE 1 TO TYPE-PART.
    IF LAST-KEY = "04" OR LAST-KEY = "05"
      MOVE 1 TO TITLE-FLAG.
    MOVE 0 TO Q.
    MOVE TASK-KEY TO DEVICE-KEY.
    MOVE DEVICE-KEY TO REQ-TASK-NO.
    READ DEVICE-FILE RECORD INVALID KEY
      GO TO DISPLAY-TASKS-END.
    IF LAST-KEY = "01" GO TO DISPLAY-TASKS-END.
DISPLAY-TASKS-LOOP.
    MOVE 0 TO I.
    DISPLAY (5, 1)ERASE.
    DISPLAY (LIN, COL)"          ".
    GO TO DISPLAY-20-DEVICES.
DISPLAY-20-DEVICES.
    MOVE DEVICE-KEY TO READ-TASK-NO.
    MOVE DEVICE-KEY TO TASK-KEY.
```

```
    IF READ-TYPE NOT = REQ-TYPE MOVE 1 TO Q.
    ADD 1 TO I.
    IF I > 16 OR Q = 1
      DISPLAY(25, 7)"Hit any key to continue"
      ACCEPT(LIN, COL)NOTHING WITH AUTO-SKIP
      ACCEPT LAST-KEY FROM ESCAPE KEY
      DISPLAY(6, 1)ERASE
      MOVE 1 TO I
      IF Q = 1 GO TO DISPLAY-TASKS-END.
    IF LAST-KEY = "01" GO TO DISPLAY-TASKS-END.
    IF  READ-SUBTASK NOT = "0000"
     DISPLAY (LIN, COL) "  ".
    DISPLAY TASK-PART, "  ", DEVICE-TITLE.
    IF TITLE-FLAG = 1
      PERFORM DISPLAY-CONTROLS THRU DISPLAY-CONTROLS-END.
    READ DEVICE-FILE NEXT RECORD AT END MOVE 1 TO Q.
    GO TO DISPLAY-20-DEVICES.
DISPLAY-TASKS-END.
    MOVE 0 TO TITLE-FLAG.
    DISPLAY(6, 1)ERASE.
DISPLAY-CONTROLS.
    MOVE DEVICE-KEY TO TASK-KEY.
    MOVE SPACES TO CONTROL-PART.
    MOVE TASK-KEY TO TITLE-KEY.
    START TITLE-FILE KEY IS NOT LESS THAN TITLE-KEY
      INVALID KEY GO TO DISPLAY-CONTROLS-END.
    READ TITLE-FILE NEXT RECORD AT END
         GO TO DISPLAY-CONTROLS-END.
DISPLAY-20-CONTROLS.
    IF TITLE-TASK NOT = TASK-PART OR TITLE-TYPE NOT = TYPE-PART
        GO TO DISPLAY-CONTROLS-END.
    ADD 1 TO I.
    IF I > 16
      DISPLAY(25, 7)"Hit any key to continue"
      ACCEPT(LIN, COL)NOTHING WITH AUTO-SKIP
      ACCEPT LAST-KEY FROM ESCAPE KEY
      DISPLAY(6, 1)ERASE
      DISPLAY TASK-PART, "  ", DEVICE-TITLE
      MOVE 1 TO I.
    IF LAST-KEY = "01" GO TO DISPLAY-CONTROLS-END.
    DISPLAY "       ",  TITLE-CONTROL,
      " ", TITLE-DESC.
    READ TITLE-FILE NEXT RECORD AT END
         GO TO DISPLAY-CONTROLS-END.
    GO TO DISPLAY-20-CONTROLS.
DISPLAY-CONTROLS-END.
    EXIT.
SQUARE-ROOT.
    COMPUTE SQR1 = SQR-ROOT * 10000.
    PERFORM SQR-PROC VARYING J FROM 1 BY 2 UNTIL SQR1 < 0.
    COMPUTE SQR-ROOT ROUNDED = (J - 3) / 200.
SQR-PROC.
    SUBTRACT J FROM SQR1.
```

```
 IDENTIFICATION DIVISION.
 PROGRAM-ID.    DEFT3.
*-----------------------------------------------
* THIS IS THE DEFT III  ANALYSIS PROGRAM
*-----------------------------------------------
 AUTHOR. Timothy OConnor.
 INSTALLATION. American Institutes for Research.
 DATE-WRITTEN.  AUG 1984.
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.
 OBJECT-COMPUTER.
 INPUT-OUTPUT SECTION.
 FILE-CONTROL.

       SELECT DEVICE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS DEVICE-KEY
            FILE STATUS IS DEVICE-STATUS-WORD.

      SELECT TITLE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS TITLE-KEY
            FILE STATUS IS TITLE-STATUS-WORD.

      SELECT CONTROL-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS CONTROL-KEY
            FILE STATUS IS CTL-STATUS-WORD.

     SELECT TEXT-FILE ASSIGN TO DISK
             ORGANIZATION IS LINE SEQUENTIAL.

 DATA DIVISION.
 FILE SECTION.
 FD  DEVICE-FILE
        LABEL RECORD IS STANDARD;
        VALUE OF FILE-ID IS "B:DEVICE".
 01  DEVICE-RECORD.
     05 DEVICE-KEY    PIC X(10).
     05 DEVICE-ANALYSIS OCCURS 20 TIMES PIC 999.
     05 DEVICE-TITLE    PIC X(60).


 FD  TITLE-FILE
         LABEL RECORD IS STANDARD;
         VALUE OF FILE-ID IS "B:TITLE".
 01  TITLE-RECORD.
     05 TITLE-KEY.
       07 TITLE-TYPE      PIC 9.
       07 TITLE-TASK      PIC X(9).
       07 TITLE-PERIOD    PIC X.
```

```
      07 TITLE-CONTROL  PIC X(9).
    05 TITLE-DESC       PIC X(60).

FD  CONTROL-FILE
        LABEL RECORD IS STANDARD;
       VALUE OF FILE-ID IS "B:CONTROL".
01  CONTROL-RECORD.
    05 CONTROL-KEY.
       07 CTL-TYPE     PIC 9.
       07 CTL-TASK     PIC X(4).
       07 FILLER       PIC X.
       07 CTL-SUBTASK  PIC X(4).
       07 FILLER       PIC X.
       07 CTL-NO       PIC X(9).
    05 CONTROL-ANALYSIS OCCURS 2 TIMES  PIC 999.
    05 CORR-CTL-KEY   PIC X(20).

FD  TEXT-FILE
        LABEL RECORD IS STANDARD;
        VALUE OF FILE-ID IS "A:DEFT3.DOC".
01  TEXT-RECORD.
    05 REC-INDICATOR      PIC XX.
    05 FILLER             PIC X.
    05 ANALYSIS-NUMBER    PIC X.
    05 FILLER           PIC X(75).


WORKING-STORAGE SECTION.
77  NOTHING PIC X.
77  TASK-NO  PIC Z(3)9.9999 DISPLAY.
77  RATING PIC 999.
77  PREVIOUS-RATING PIC ZZ9.
77  CTL-STATUS-WORD    PIC XX.
77  DEVICE-STATUS-WORD  PIC XX.
77  TITLE-STATUS-WORD  PIC XX.
77  EOF-CONTROL   PIC 9  VALUE 0.
77  EOF-DEVICE  PIC 9  VALUE 0.
77  PREV-OPTION      PIC 9 COMP.
77  OPTION      PIC 9 COMP.
77  LAST-KEY    PIC XX.
77  X    PIC 9(4) COMP.
77  Q    PIC 9(4) COMP.
77  Z    PIC 9(4) COMP.
77  K    PIC 9(4) COMP.
77  I    PIC 9(4) COMP.
77  DISPLAY-NUMBER  PIC  ZZ,ZZZ.99.
77  TRAINING-PROBLEM   PIC 9(5)V99 COMP.
77  ACQUISITION-EFFICIENCY   PIC 9(5)V99 COMP.
77  TRAINING-ACQUISITION  PIC 9(5)V99 COMP.
77  TRANSFER-PROBLEM   PIC 9(5)V99 COMP.
77  TRANSFER-EFFICIENCY  PIC 9(5)V99 COMP.
77  ADDITIONAL-DEFICIT  PIC S9999 COMP.
77  TRAINING-TRANSFER   PIC 9(5)V99 COMP.
77  DEFT PIC 9(5)V99.
77  N1 PIC 9(4) COMP.
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77  N2 PIC 9(4) COMP.
77  N3 PIC 9(4) COMP.
77  N4 PIC 9(4) COMP.
77  N5 PIC 9(4) COMP.
77  TP-PRODUCT PIC 9(8) COMP.
77  AE-PRODUCT PIC 9(8)V99 COMP.
77  RD-PRODUCT PIC 9(8) COMP.
77  TE-PRODUCT PIC 9(8)V99 COMP.
77  PS-FS PIC 9(8) COMP.
77  DIFFICULTY PIC 9(4) COMP.
77  ANSWER PIC X.
01  TITLE-FLAG  PIC S9(4) COMP VALUE 0.
01  REQ-TASK-NO.
    05 REQ-TYPE  PIC 9.
    05 REQ-TASK    PIC Z(4).
    05 FILLER  PIC X.
    05 REQ-SUBTASK    PIC X(4).
01  READ-TASK-NO.
    05 READ-TYPE  PIC 9.
    05 READ-TASK1  PIC Z(4).
    05 FILLER  PIC X.
    05 READ-SUBTASK PIC X(4).
01  TASK-KEY.
    05 TYPE-PART  PIC X.
    05 TASK-PART  PIC X(9).
    05 PERIOD-PART PIC X VALUE ".".
    05 CONTROL-PART PIC X(9).
01  REQ-CTL-KEY.
    05 REQ-CTL-TYPE     PIC 9.
    05 REQ-CTL-TASK     PIC X(4).
    05 FILLER       PIC X.
    05 REQ-CTL-SUBTASK  PIC X(4).
    05 FILLER       PIC X.
    05 REQ-CTL-NO       PIC X(9).
01  SQR1                PIC S9(9) COMP.
01  SQR-ROOT             PIC 9(5)V99  COMP.
01  J                   PIC 9(9) COMP.

PROCEDURE DIVISION.
BEGIN.
    OPEN I-O DEVICE-FILE.
    OPEN I-O TITLE-FILE.
    OPEN I-O CONTROL-FILE.
    OPEN INPUT TEXT-FILE.
    DISPLAY (1, 1) ERASE.
    MOVE ZEROS TO TASK-NO.
    MOVE TASK-NO TO REQ-TASK-NO.
    MOVE 0 TO OPTION.
MENU.
    MOVE OPTION TO PREV-OPTION.
    MOVE 0 TO OPTION.
    MOVE 0 TO EOF-DEVICE
    MOVE "00" TO LAST-KEY
    DISPLAY (1, 1)ERASE.
    DISPLAY (1, 25)
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                "        DEFT III                          ".
    DISPLAY (4, 25)
                "(1)  Performance Deficit                  ".
    DISPLAY (5, 25)
                "(2)  Learning Difficulty                  ".
    DISPLAY (6, 25)
                "(3)  Quality of Training-Acquisition      ".
    DISPLAY (7, 25)
                "(4)  Residual Deficit                     ".
    DISPLAY (8, 25)
                "(5)  Residual Learning Difficulty         ".
    DISPLAY (9, 25)
                "(6)  Physical Similarity                  ".
    DISPLAY (10, 25)
                "(7)  Functional Similarity                ".
    DISPLAY (11, 25)
                "(8)  Quality of Training-Transfer         ".
    DISPLAY (12, 25)
                "(9)  Evaluation Summary                   ".
    DISPLAY (16, 12)"Enter Option Number ".
    ACCEPT (LIN, COL) OPTION WITH AUTO-SKIP.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO STOP-RUN.
    DISPLAY (1, 1)ERASE.
    IF OPTION = 1 GO TO PERFORMANCE-DEFICIT-ANALYSIS.
    IF OPTION = 2 GO TO LEARNING-DIFFICULTY-ANALYSIS.
    IF OPTION = 3 GO TO TRAINING-ACQUISITION-ANALYSIS.
    IF OPTION = 4 GO TO RESIDUAL-DEFICIT-ANALYSIS.
    IF OPTION = 5 GO TO RESIDUAL-DIFFICULTY-ANALYSIS.
    IF OPTION = 6 GO TO PHYSICAL-SIMILARITY-ANALYSIS.
    IF OPTION = 7 GO TO FUNCTIONAL-SIMILARITY-ANALYSIS.
    IF OPTION = 8 GO TO TRAINING-TRANSFER-ANALYSIS.
    IF OPTION = 9 GO TO EVALUATION-SUMMARY.
    GO TO MENU.
PERFORMANCE-DEFICIT-ANALYSIS.
    MOVE 0 TO TYPE-PART.
    MOVE 3 TO X.
    MOVE 3 TO Z.
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT  VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
LEARNING-DIFFICULTY-ANALYSIS.
    MOVE 0 TO TYPE-PART.
    MOVE 4 TO X.
    MOVE 9 TO Z
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
TRAINING-ACQUISITION-ANALYSIS.
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    MOVE 0 TO TYPE-PART.
    MOVE 10 TO X.
    MOVE 20 TO Z
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
RESIDUAL-DEFICIT-ANALYSIS.
    MOVE 1 TO TYPE-PART.
    MOVE 6 TO X.
    MOVE 6 TO Z
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
RESIDUAL-DIFFICULTY-ANALYSIS.
    MOVE 1 TO TYPE-PART.
    MOVE 7 TO X.
    MOVE 12 TO Z
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
PHYSICAL-SIMILARITY-ANALYSIS.
    MOVE 1 TO TYPE-PART.
    MOVE 1 TO X.
    MOVE 1 TO Z
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-CONTROLS THRU RATE-CONTROLS-EXIT VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
FUNCTIONAL-SIMILARITY-ANALYSIS.
    MOVE 1 TO TYPE-PART.
    MOVE 2 TO X.
    MOVE 2 TO Z
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-CONTROLS THRU RATE-CONTROLS-EXIT VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
TRAINING-TRANSFER-ANALYSIS.
    MOVE 1 TO TYPE-PART.
    MOVE 13 TO X.
    MOVE 20 TO Z
    PERFORM FIND-STARTING-TASK.
```

```
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
      FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
    GO TO MENU.
EVALUATION-SUMMARY.
    DISPLAY (1, 1)ERASE.
    DISPLAY (2, 5) "Evaluate by (T)ask or (S)ubtask ? ".
    MOVE SPACES TO ANSWER.
    MOVE "0000" TO REQ-SUBTASK.
    ACCEPT (LIN, COL) ANSWER WITH AUTO-SKIP.
    IF ANSWER = "S" OR ANSWER = "s" MOVE "9999" TO REQ-SUBTASK.
    MOVE 0 TO TRAINING-PROBLEM.
    MOVE 0 TO TRAINING-ACQUISITION.
    MOVE 0 TO TRANSFER-PROBLEM.
    MOVE 0 TO ADDITIONAL-DEFICIT.
    MOVE 0 TO TRAINING-TRANSFER.
    MOVE 0 TO DEFT.
    MOVE 0 TO N1.
    MOVE 0 TO N2.
    MOVE 0 TO N3.
    MOVE 0 TO N4.
    MOVE 0 TO N5.
    MOVE 0 TO TP-PRODUCT.
    MOVE 0 TO AE-PRODUCT.
    MOVE 0 TO RD-PRODUCT.
    MOVE 0 TO TE-PRODUCT.
    MOVE 0 TO PS-FS.
    MOVE "0    0.0000" TO DEVICE-KEY.
    READ DEVICE-FILE RECORD INVALID KEY GO TO BAD-KEY.
    PERFORM SUM-TASK THRU SUM-TASK-EXIT VARYING I FROM 1 BY 1
      UNTIL EOF-DEVICE = 1.
    DISPLAY (1, 1)ERASE.
    DISPLAY (1, 31) "Evaluation Summary".
    DISPLAY (3, 1)
                "          Training Problem                    ".
    IF N1 NOT = 0
     COMPUTE TRAINING-PROBLEM ROUNDED = TP-PRODUCT / N1
     MOVE TRAINING-PROBLEM TO DISPLAY-NUMBER
     DISPLAY (LIN, COL) DISPLAY-NUMBER.
    DISPLAY (5, 1)
                "          Acquisition-Efficiency              ".
    MOVE 999 TO ACQUISITION-EFFICIENCY.
    IF N2 NOT = 0
     COMPUTE ACQUISITION-EFFICIENCY ROUNDED =
         AE-PRODUCT / (N2 * 100)
      MOVE ACQUISITION-EFFICIENCY TO SQR-ROOT
      PERFORM SQUARE-ROOT
      MOVE SQR-ROOT TO ACQUISITION-EFFICIENCY
     MOVE ACQUISITION-EFFICIENCY TO DISPLAY-NUMBER
     DISPLAY (LIN, COL) DISPLAY-NUMBER.
    DISPLAY (7, 10)
                "          Acquisition                         ".
     IF ACQUISITION-EFFICIENCY = 0
       MOVE .01 TO ACQUISITION-EFFICIENCY.
    IF ACQUISITION-EFFICIENCY NOT = 999
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```
      COMPUTE TRAINING-ACQUISITION ROUNDED =
       TRAINING-PROBLEM / ACQUISITION-EFFICIENCY
      MOVE TRAINING-ACQUISITION TO DISPLAY-NUMBER
      DISPLAY(LIN, COL) DISPLAY-NUMBER.
    DISPLAY (9, 1)
                "              Transfer Problem                    ".
    IF N5 NOT = 0 AND PS-FS NOT = 0
      COMPUTE ADDITIONAL-DEFICIT ROUNDED = PS-FS / N5.
    IF N3 NOT = 0
      COMPUTE TRANSFER-PROBLEM ROUNDED =
        (RD-PRODUCT / N3) +  ADDITIONAL-DEFICIT
      MOVE TRANSFER-PROBLEM TO DISPLAY-NUMBER
      DISPLAY (LIN, COL) DISPLAY-NUMBER.
    DISPLAY (11, 1)
                "              Transfer Efficiency                 ".
    MOVE 999 TO TRANSFER-EFFICIENCY.
    IF N4 NOT = 0
       COMPUTE TRANSFER-EFFICIENCY ROUNDED =
        TE-PRODUCT / (N4 * 100)
      MOVE TRANSFER-EFFICIENCY TO SQR-ROOT
      PERFORM SQUARE-ROOT
      MOVE SQR-ROOT TO TRANSFER-EFFICIENCY
       MOVE TRANSFER-EFFICIENCY TO DISPLAY-NUMBER
       DISPLAY(LIN, COL) DISPLAY-NUMBER.
    DISPLAY (13, 10)
                "              Transfer                            ".
     IF TRANSFER-EFFICIENCY = 0
       MOVE .01 TO TRANSFER-EFFICIENCY.
    IF TRANSFER-EFFICIENCY NOT = 999
      COMPUTE TRAINING-TRANSFER ROUNDED =
         TRANSFER-PROBLEM / TRANSFER-EFFICIENCY
      MOVE TRAINING-TRANSFER TO DISPLAY-NUMBER
      DISPLAY(LIN, COL) DISPLAY-NUMBER.
    DISPLAY (16, 10)
                "                    d                             ".
    COMPUTE DEFT = TRAINING-ACQUISITION +      '
                        TRAINING-TRANSFER.
    MOVE DEFT TO DISPLAY-NUMBER.
    DISPLAY (LIN, COL) DISPLAY-NUMBER.
    DISPLAY (20, 5)ERASE.
    PERFORM HIT-ANY-KEY.
    GO TO MENU.
EVALUATION-SUMMARY-EXIT.
    EXIT.
FIND-SCREEN.
    IF ANALYSIS-NUMBER > OPTION OR OPTION = PREV-OPTION
       CLOSE TEXT-FILE
       OPEN INPUT TEXT-FILE
       MOVE 0 TO PREV-OPTION
       READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    DISPLAY (1, 1) ERASE.
READ-TEXT.
    IF REC-INDICATOR = "ZZ" AND
      ANALYSIS-NUMBER = OPTION GO TO DISPLAY-SCREEN.
    IF REC-INDICATOR = "ZQ" AND ANALYSIS-NUMBER = OPTION
```

```
          PERFORM DISPLAY-INTRO-SCREEN THRU
                  DISPLAY-INTRO-SCREEN-EXIT
          PERFORM HIT-ANY-KEY
          GO TO DISPLAY-SCREEN.
      READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
      GO TO READ-TEXT.
DISPLAY-SCREEN.
      IF LAST-KEY = "01" GO TO DISPLAY-SCREEN-EXIT.
      READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
      IF REC-INDICATOR = "ZZ" OR REC-INDICATOR = "ZQ"
        GO TO DISPLAY-SCREEN-EXIT.
      DISPLAY TEXT-RECORD.
      GO TO DISPLAY-SCREEN.
DISPLAY-SCREEN-EXIT.
      EXIT.
HIT-ANY-KEY.
      DISPLAY (LIN, COL) "Hit any key to continue ".
      ACCEPT (LIN, COL) NOTHING WITH AUTO-SKIP.
      ACCEPT LAST-KEY FROM ESCAPE KEY.
      DISPLAY(1, 1)ERASE.
FIND-STARTING-TASK.
      DISPLAY (5, 1)ERASE.
      MOVE ZEROS TO TASK-NO.
      DISPLAY (22, 5)
       "Hit 'F1' to List Training Device Tasks & Subtasks".
      DISPLAY (23, 5)
       "Hit 'F2' to List Operational Equipment Tasks & Subtasks".
      DISPLAY (24, 5)
       "Hit 'F3' to List Training Device Controls & Displays".
      DISPLAY (25, 5)
       "Hit 'F4' to List Operational Equipment ",
            "Controls & Displays".
      IF OPTION < 4
       MOVE 0 TO TYPE-PART
       DISPLAY (5, 1)
       "Enter Starting Training Device Task.Subtask number  "
      ELSE IF OPTION < 9
           MOVE 1 TO TYPE-PART
           DISPLAY (5, 1)
           "Enter Starting Operational Equipment Task.Subtask ",
           "number  ".
      ACCEPT (LIN, COL) TASK-NO WITH AUTO-SKIP PROMPT.
      ACCEPT LAST-KEY FROM ESCAPE KEY.
      MOVE TASK-NO TO TASK-PART.
      MOVE TASK-KEY TO REQ-TASK-NO.
      IF LAST-KEY = "02" OR LAST-KEY = "03" OR
        LAST-KEY = "04" OR LAST-KEY = "05"
        PERFORM DISPLAY-TASKS THRU DISPLAY-TASKS-END
        GO TO FIND-STARTING-TASK.
      IF LAST-KEY  = "00"
        MOVE TASK-KEY TO REQ-TASK-NO
        MOVE REQ-TASK-NO TO DEVICE-KEY
        START DEVICE-FILE KEY IS EQUAL TO DEVICE-KEY
                  INVALID KEY
                      DISPLAY (LIN, 1) ERASE
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                    DISPLAY (LIN, 1)
                    "TASK.SUBTASK NOT FOUND IN DATA BASE "
                    PERFORM TIMER
                    GO TO FIND-STARTING-TASK.
READ-TASK.
    MOVE 0 TO EOF-DEVICE.
    READ DEVICE-FILE NEXT RECORD AT END MOVE 1 TO EOF-DEVICE
          GO TO READ-TASK-EXIT.
    MOVE DEVICE-KEY TO READ-TASK-NO.
    MOVE DEVICE-KEY TO TASK-KEY.
    IF TASK-PART = "   0.0000" GO TO READ-TASK.
    IF REQ-TYPE NOT = READ-TYPE GO TO READ-TASK.
    IF REQ-SUBTASK = "0000" AND READ-SUBTASK NOT = "0000"
      GO TO READ-TASK.
    IF REQ-SUBTASK NOT = "0000" AND READ-SUBTASK = "0000"
      GO TO READ-TASK.
    IF (OPTION = 2  OR OPTION = 3) AND
        DEVICE-ANALYSIS(3) > 3
      GO TO READ-TASK.
    IF OPTION > 4 AND DEVICE-ANALYSIS(6) > 3
      GO TO READ-TASK.
    IF (OPTION = 6 OR OPTION = 7) AND
        DEVICE-ANALYSIS(5) NOT = 1
      GO TO READ-TASK.
READ-TASK-EXIT.
    EXIT.
RATE-TASKS.
    PERFORM READ-TASK THRU READ-TASK-EXIT.
    IF EOF-DEVICE = 1 GO TO RATE-TASKS-EXIT.
    PERFORM RATE-EACH-TASK THRU RATE-EACH-TASK-EXIT
      VARYING K FROM X BY 1 UNTIL K > Z  OR  LAST-KEY = "01".
    IF LAST-KEY = "01" GO TO RATE-TASKS-EXIT.
RATE-TASKS-EXIT.
    EXIT.
RATE-EACH-TASK.
    IF X NOT = Z
      DISPLAY (1, 1) ERASE
      PERFORM FIND-SCREEN THRU DISPLAY-SCREEN-EXIT.
    IF LAST-KEY = "01" GO TO RATE-EACH-TASK-EXIT.
    DISPLAY (23 , 1)ERASE.
    DISPLAY (LIN, 1) "Task.Subtask = ", TASK-PART, " ",
              DEVICE-TITLE
    MOVE DEVICE-ANALYSIS(K) TO RATING.
    IF RATING NOT = 999
      MOVE RATING TO PREVIOUS-RATING
      DISPLAY (LIN, 1) "Previous Rating = ", PREVIOUS-RATING.
    DISPLAY (LIN, COL) "    Enter Rating = "
    ACCEPT (LIN, COL) RATING WITH AUTO-SKIP UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO RATE-EACH-TASK-EXIT.
    IF RATING = PREVIOUS-RATING GO TO RATE-EACH-TASK-EXIT.
    MOVE RATING TO DEVICE-ANALYSIS(K)
    REWRITE DEVICE-RECORD INVALID KEY GO TO BAD-KEY.
RATE-EACH-TASK-EXIT.
    EXIT.
```

```
RATE-CONTROLS.
    PERFORM READ-TASK THRU READ-TASK-EXIT.
    IF EOF-DEVICE = 1 GO TO RATE-CONTROLS-EXIT.
    MOVE DEVICE-KEY TO REQ-CTL-KEY.
    MOVE DEVICE-KEY TO TASK-KEY.
    MOVE REQ-CTL-TYPE TO CONTROL-KEY.
    MOVE REQ-CTL-TASK TO CTL-TASK.
    MOVE 0 TO EOF-CONTROL.
    MOVE 0 TO EOF-DEVICE.
    START CONTROL-FILE KEY IS NOT LESS THAN CONTROL-KEY
          INVALID KEY
            GO TO RATE-CONTROLS-EXIT.
    DISPLAY (21 , 1)ERASE.
    DISPLAY "Task = ", TASK-PART, " ", DEVICE-TITLE.
    PERFORM RATE-EACH-CONTROL THRU RATE-EACH-CONTROL-EXIT
     VARYING K FROM 1 BY 1 UNTIL EOF-CONTROL = 1 OR
      EOF-DEVICE = 1 OR LAST-KEY = "01".
    IF LAST-KEY = "01" GO TO RATE-CONTROLS-EXIT.
RATE-CONTROLS-EXIT.
    EXIT.
RATE-EACH-CONTROL.
    MOVE 0 TO EOF-CONTROL.
    READ CONTROL-FILE NEXT RECORD AT END
      MOVE 1 TO EOF-CONTROL
      GO TO RATE-EACH-CONTROL-EXIT.
    IF REQ-CTL-TYPE NOT = CTL-TYPE OR
      REQ-CTL-TASK NOT = CTL-TASK
      GO TO RATE-EACH-CONTROL-EXIT.
    IF REQ-CTL-SUBTASK NOT = "0000" AND
      REQ-CTL-SUBTASK NOT = CTL-SUBTASK
      GO TO RATE-EACH-CONTROL-EXIT.
    MOVE CONTROL-KEY TO TITLE-KEY.
    READ TITLE-FILE RECORD INVALID KEY PERFORM BAD-KEY.
    DISPLAY (22, 1)ERASE.
    DISPLAY (22, 1)" ", TITLE-CONTROL, " ", TITLE-DESC.
    MOVE CORR-CTL-KEY TO DEVICE-KEY.
    READ DEVICE-FILE RECORD INVALID KEY PERFORM BAD-KEY.
    MOVE DEVICE-KEY TO TASK-KEY.
    DISPLAY (23, 1)"Task = ", TASK-PART, " ", DEVICE-TITLE.
    MOVE CORR-CTL-KEY TO TITLE-KEY.
    READ TITLE-FILE RECORD INVALID KEY PERFORM BAD-KEY.
    DISPLAY(24, 1) " ", TITLE-CONTROL, " ", TITLE-DESC.
    MOVE CONTROL-ANALYSIS(X) TO RATING.
    DISPLAY (25, 5)ERASE.
    IF RATING NOT = 999
      MOVE RATING TO PREVIOUS-RATING
      DISPLAY (25, 5)"Previous Rating = ", PREVIOUS-RATING.
    DISPLAY (LIN, COL) "    Enter Rating = "
    ACCEPT (LIN, COL) RATING WITH AUTO-SKIP UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO RATE-EACH-CONTROL-EXIT.
    IF RATING = PREVIOUS-RATING GO TO RATE-EACH-CONTROL-EXIT.
    MOVE RATING TO CONTROL-ANALYSIS(X)
    REWRITE CONTROL-RECORD INVALID KEY GO TO BAD-KEY.
RATE-EACH-CONTROL-EXIT.
```

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    MOVE READ-TASK-NO TO DEVICE-KEY.
    READ DEVICE-FILE RECORD
          INVALID KEY MOVE 1 TO EOF-DEVICE.
STOP-RUN.
    DISPLAY(1, 1)ERASE.
    CLOSE DEVICE-FILE.
    CLOSE TITLE-FILE.
    CLOSE CONTROL-FILE.
    CLOSE TEXT-FILE.
    EXIT PROGRAM.
STOPPED.
    STOP RUN.
EOF-TEXT.
    DISPLAY "EOF ON TEXT FILE".
    STOP RUN.
BAD-KEY.
    DISPLAY "INVALID KEY ", DEVICE-KEY, TITLE-KEY.
    STOP RUN.
TIMER.
    PERFORM NO-OP 2000 TIMES.
NO-OP.
    EXIT.
DISPLAY-INTRO-SCREEN.
    READ TEXT-FILE RECORD AT END GO TO EOF-TEXT.
    IF REC-INDICATOR = "ZZ" OR REC-INDICATOR = "ZQ"
      GO TO DISPLAY-INTRO-SCREEN-EXIT.
    DISPLAY TEXT-RECORD.
    GO TO DISPLAY-INTRO-SCREEN.
DISPLAY-INTRO-SCREEN-EXIT.
    EXIT.
SUM-TASK.
    MOVE 0 TO EOF-DEVICE.
    READ DEVICE-FILE NEXT RECORD AT END MOVE 1 TO EOF-DEVICE
          GO TO SUM-TASK-EXIT.
    MOVE DEVICE-KEY TO READ-TASK-NO.
    IF REQ-SUBTASK = "0000" AND READ-SUBTASK NOT = "0000"
      GO TO SUM-TASK.
    IF REQ-SUBTASK NOT = "0000" AND READ-SUBTASK = "0000"
      GO TO SUM-TASK.
    IF READ-TYPE = 1 GO TO SUM-ACTUALS.
    IF DEVICE-ANALYSIS(3) > 3 ADD 1 TO N1
                GO TO SUM-TASK-EXIT.
    IF DEVICE-ANALYSIS(3) NOT = 999
      MOVE 999 TO DIFFICULTY
      IF DEVICE-ANALYSIS(3) < 4  AND
        DEVICE-ANALYSIS(4) NOT = 999 AND
        DEVICE-ANALYSIS(5) NOT = 999 AND
        DEVICE-ANALYSIS(6) NOT = 999 AND
        DEVICE-ANALYSIS(7) NOT = 999 AND
        DEVICE-ANALYSIS(8) NOT = 999 AND
        DEVICE-ANALYSIS(9) NOT = 999
         ADD 1 TO N1
         COMPUTE DIFFICULTY ROUNDED =
          DEVICE-ANALYSIS (4) +
          DEVICE-ANALYSIS (5) +
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            DEVICE-ANALYSIS (6) +
            DEVICE-ANALYSIS (7) +
            DEVICE-ANALYSIS (8) +
            DEVICE-ANALYSIS (9).
      IF DEVICE-ANALYSIS(3) = 0 AND DIFFICULTY NOT = 999
         COMPUTE TP-PRODUCT ROUNDED = TP-PRODUCT +
          (10 * DIFFICULTY).
      IF DEVICE-ANALYSIS(3) = 1 AND DIFFICULTY NOT = 999
         COMPUTE TP-PRODUCT ROUNDED = TP-PRODUCT +
          (9 * DIFFICULTY).
      IF DEVICE-ANALYSIS(3) = 2 AND DIFFICULTY NOT = 999
         COMPUTE TP-PRODUCT ROUNDED = TP-PRODUCT +
          (7 * DIFFICULTY).
      IF DEVICE-ANALYSIS(3) = 3 AND DIFFICULTY NOT = 999
         COMPUTE TP-PRODUCT ROUNDED = TP-PRODUCT +
          (4 * DIFFICULTY).

      IF DEVICE-ANALYSIS(3) < 4 AND
        DEVICE-ANALYSIS(10) NOT = 999 AND
        DEVICE-ANALYSIS(11) NOT = 999 AND
        DEVICE-ANALYSIS(12) NOT = 999 AND
        DEVICE-ANALYSIS(13) NOT = 999 AND
        DEVICE-ANALYSIS(14) NOT = 999 AND
        DEVICE-ANALYSIS(15) NOT = 999 AND
        DEVICE-ANALYSIS(16) NOT = 999 AND
        DEVICE-ANALYSIS(17) NOT = 999 AND
        DEVICE-ANALYSIS(18) NOT = 999 AND
        DEVICE-ANALYSIS(19) NOT = 999 AND
        DEVICE-ANALYSIS(20) NOT = 999
        ADD 1 TO N2
        COMPUTE AE-PRODUCT ROUNDED =
          AE-PRODUCT +
          ((DEVICE-ANALYSIS(10) +
          DEVICE-ANALYSIS(11) +
          DEVICE-ANALYSIS(12) +
          DEVICE-ANALYSIS(13) +
          DEVICE-ANALYSIS(14) +
          DEVICE-ANALYSIS(15) +
          DEVICE-ANALYSIS(16) +
          DEVICE-ANALYSIS(17) +
          DEVICE-ANALYSIS(18) +
          DEVICE-ANALYSIS(19) +
          DEVICE-ANALYSIS(20)) / 11 ).
      GO TO SUM-TASK-EXIT.
SUM-ACTUALS.
      IF READ-TYPE = 0 GO TO SUM-TASK-EXIT.
      IF DEVICE-ANALYSIS(6) > 3  ADD 1 TO N3
          GO TO SUM-TASK-EXIT.

      IF DEVICE-ANALYSIS(6) NOT = 999
        MOVE 999 TO DIFFICULTY
        IF DEVICE-ANALYSIS(6) < 4  AND
          DEVICE-ANALYSIS(7) NOT = 999 AND
          DEVICE-ANALYSIS(8) NOT = 999 AND
          DEVICE-ANALYSIS(9) NOT = 999 AND
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           DEVICE-ANALYSIS(10) NOT = 999 AND
           DEVICE-ANALYSIS(11) NOT = 999 AND
           DEVICE-ANALYSIS(12) NOT = 999
            ADD 1 TO N3
            COMPUTE DIFFICULTY ROUNDED =
             DEVICE-ANALYSIS (7) +
             DEVICE-ANALYSIS (8) +
             DEVICE-ANALYSIS (9) +
             DEVICE-ANALYSIS (10) +
             DEVICE-ANALYSIS (11) +
             DEVICE-ANALYSIS (12).
       IF DEVICE-ANALYSIS(6) = 0 AND DIFFICULTY NOT = 999
          COMPUTE RD-PRODUCT ROUNDED = RD-PRODUCT +
           (10 * DIFFICULTY).
       IF DEVICE-ANALYSIS(6) = 1 AND DIFFICULTY NOT = 999
          COMPUTE RD-PRODUCT ROUNDED = RD-PRODUCT +
           (9 * DIFFICULTY).
       IF DEVICE-ANALYSIS(6) = 2 AND DIFFICULTY NOT = 999
          COMPUTE RD-PRODUCT ROUNDED = RD-PRODUCT +
           (7 * DIFFICULTY).
       IF DEVICE-ANALYSIS(6) = 3 AND DIFFICULTY NOT = 999
          COMPUTE RD-PRODUCT ROUNDED = RD-PRODUCT +
           (4 * DIFFICULTY).
       IF DEVICE-ANALYSIS(5) = 1
         PERFORM SUM-CONTROLS THRU SUM-CONTROLS-EXIT.
       IF DEVICE-ANALYSIS(6) < 4 AND
         DEVICE-ANALYSIS(13) NOT = 999 AND
         DEVICE-ANALYSIS(14) NOT = 999 AND
         DEVICE-ANALYSIS(15) NOT = 999 AND
         DEVICE-ANALYSIS(16) NOT = 999 AND
         DEVICE-ANALYSIS(17) NOT = 999 AND
         DEVICE-ANALYSIS(18) NOT = 999 AND
         DEVICE-ANALYSIS(19) NOT = 999 AND
         DEVICE-ANALYSIS(20) NOT = 999
         ADD 1 TO N4
         COMPUTE TE-PRODUCT ROUNDED =
           TE-PRODUCT +
           ((DEVICE-ANALYSIS(13) +
           DEVICE-ANALYSIS(14) +
           DEVICE-ANALYSIS(15) +
           DEVICE-ANALYSIS(16) +
           DEVICE-ANALYSIS(17) +
           DEVICE-ANALYSIS(18) +
           DEVICE-ANALYSIS(19) +
           DEVICE-ANALYSIS(20)) / 8).
SUM-TASK-EXIT.
    EXIT.
SUM-CONTROLS.
    MOVE READ-TASK-NO TO REQ-CTL-KEY.
    MOVE REQ-CTL-KEY TO CONTROL-KEY.
    START CONTROL-FILE KEY IS NOT LESS THAN CONTROL-KEY
      INVALID KEY GO TO SUM-CONTROLS-EXIT.
SUM-EACH-CONTROL.
    READ CONTROL-FILE NEXT RECORD AT END
      GO TO SUM-CONTROLS-EXIT.
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    IF REQ-CTL-TASK NOT = CTL-TASK GO TO SUM-CONTROLS-EXIT.
    IF REQ-CTL-SUBTASK NOT = "0000" AND
      REQ-CTL-SUBTASK NOT = CTL-SUBTASK
      GO TO SUM-CONTROLS-EXIT.
    IF CONTROL-ANALYSIS(1) = 999 OR CONTROL-ANALYSIS(2) = 999
      GO TO SUM-CONTROLS-EXIT.
    ADD 1 TO N5.
    IF CONTROL-ANALYSIS(1) > CONTROL-ANALYSIS(2)
      COMPUTE PS-FS = PS-FS +
        (CONTROL-ANALYSIS(1) - CONTROL-ANALYSIS(2)).
    GO TO SUM-EACH-CONTROL.
SUM-CONTROLS-EXIT.
    EXIT.
DISPLAY-TASKS.
    IF LAST-KEY = "04" OR LAST-KEY = "05"
      MOVE 1 TO TITLE-FLAG.
    IF LAST-KEY = "03" OR LAST-KEY = "05"
      MOVE 1 TO TYPE-PART.
    MOVE 0 TO Q.
    MOVE TASK-KEY TO DEVICE-KEY.
    MOVE DEVICE-KEY TO REQ-TASK-NO.
    READ DEVICE-FILE RECORD INVALID KEY
      GO TO DISPLAY-TASKS-END.
    IF LAST-KEY = "01" GO TO DISPLAY-TASKS-END.
DISPLAY-TASKS-LOOP.
    MOVE 0 TO I.
    DISPLAY (5, 1)ERASE.
    DISPLAY (LIN, COL)"          ".
    GO TO DISPLAY-20-DEVICES.
DISPLAY-20-DEVICES.
    MOVE DEVICE-KEY TO READ-TASK-NO.
    MOVE DEVICE-KEY TO TASK-KEY.
    IF READ-TYPE NOT = REQ-TYPE MOVE 1 TO Q.
    ADD 1 TO I.
    IF I > 16 OR Q = 1
      DISPLAY(25, 7)"Hit any key to continue"
      ACCEPT(LIN, COL)NOTHING WITH AUTO-SKIP
      ACCEPT LAST-KEY FROM ESCAPE KEY
      DISPLAY(6, 1)ERASE
      MOVE 1 TO I
      IF Q = 1 GO TO DISPLAY-TASKS-END.
    IF LAST-KEY = "01" GO TO DISPLAY-TASKS-END.
    IF  READ-SUBTASK NOT = "0000"
     DISPLAY (LIN, COL) "  ".
    DISPLAY TASK-PART, "  ", DEVICE-TITLE.
    IF TITLE-FLAG = 1
      PERFORM DISPLAY-CONTROLS THRU DISPLAY-CONTROLS-END.
    READ DEVICE-FILE NEXT RECORD AT END MOVE 1 TO Q.
    GO TO DISPLAY-20-DEVICES.
DISPLAY-TASKS-END.
    MOVE 0 TO TITLE-FLAG.
    DISPLAY(6, 1)ERASE.
DISPLAY-CONTROLS.
    MOVE DEVICE-KEY TO TASK-KEY.
    MOVE SPACES TO CONTROL-PART.
```

```
    MOVE TASK-KEY TO TITLE-KEY.
    START TITLE-FILE KEY IS NOT LESS THAN TITLE-KEY
      INVALID KEY GO TO DISPLAY-CONTROLS-END.
    READ TITLE-FILE NEXT RECORD AT END
         GO TO DISPLAY-CONTROLS-END.
DISPLAY-20-CONTROLS.
    IF TITLE-TASK NOT = TASK-PART OR TITLE-TYPE NOT = TYPE-PART
        GO TO DISPLAY-CONTROLS-END.
    ADD 1 TO I.
    IF I > 16
      DISPLAY(25, 7)"Hit any key to continue"
      ACCEPT(LIN, COL)NOTHING WITH AUTO-SKIP
      ACCEPT LAST-KEY FROM ESCAPE KEY
      DISPLAY(6, 1)ERASE
      DISPLAY TASK-PART, "  ", DEVICE-TITLE
      MOVE 1 TO I.
    IF LAST-KEY = "01" GO TO DISPLAY-CONTROLS-END.
    DISPLAY "       ",  TITLE-CONTROL,
      " ", TITLE-DESC.
    READ TITLE-FILE NEXT RECORD AT END
         GO TO DISPLAY-CONTROLS-END.
    GO TO DISPLAY-20-CONTROLS.
DISPLAY-CONTROLS-END.
    EXIT.
SQUARE-ROOT.
    COMPUTE SQR1 = SQR-ROOT * 10000.
    PERFORM SQR-PROC VARYING J FROM 1 BY 2 UNTIL SQR1 < 0.
    COMPUTE SQR-ROOT ROUNDED = (J - 3) / 200.
SQR-PROC.
    SUBTRACT J FROM SQR1.
```

```
 IDENTIFICATION DIVISION.
 PROGRAM-ID.    BLDDEFT.
*-------------------------------------------------
* THIS IS THE DEFT FILE CREATION PROGRAM
*-------------------------------------------------
 AUTHOR. Timothy OConnor.
 INSTALLATION. American Institutes for Research.
 DATE-WRITTEN.  AUG 1984.
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.
 OBJECT-COMPUTER.
 INPUT-OUTPUT SECTION.
 FILE-CONTROL.

       SELECT DEVICE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS DEVICE-KEY
            FILE STATUS IS DEVICE-STATUS-WORD.

      SELECT TITLE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS TITLE-KEY
            FILE STATUS IS TITLE-STATUS-WORD.

      SELECT CONTROL-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS CTL-KEY
            FILE STATUS IS CTL-STATUS-WORD.

 DATA DIVISION.
 FILE SECTION.
 FD  DEVICE-FILE
        LABEL RECORD IS STANDARD;
        VALUE OF FILE-ID IS "DEVICE".
 01  DEVICE-RECORD.
     05 DEVICE-KEY    PIC X(10).
     05 DEVICE-ANALYSIS OCCURS 20 TIMES PIC 9(3).
     05 DEVICE-TITLE    PIC X(60).

 FD  TITLE-FILE
         LABEL RECORD IS STANDARD;
         VALUE OF FILE-ID IS "TITLE".
 01  TITLE-RECORD.
     05 TITLE-KEY      PIC X(20).
     05 TITLE-DESC        PIC X(60).

 FD  CONTROL-FILE
         LABEL RECORD IS STANDARD;
        VALUE OF FILE-ID IS "CONTROL".
 01  CONTROL-RECORD.
     05 CTL-KEY     PIC X(20).
```

```
    05 CTL-PHYSICAL-SIM  PIC 999.
    05 CTL-FUNCTIONAL-SIM  PIC 999.
    05 CORR-CTL-KEY  PIC X(20).

WORKING-STORAGE SECTION.
01  NOTHING PIC X.
01  CTL-STATUS-WORD    PIC XX.
01  DEVICE-STATUS-WORD  PIC XX.
01  TITLE-STATUS-WORD  PIC XX.
01  OPTION      PIC 99.
01  LAST-KEY    PIC XX.

PROCEDURE DIVISION.
BEGIN.
    DISPLAY (1, 1) ERASE.
    DISPLAY (10, 10)
      "BUILDING DEVICE, CONTROL & DISPLAY, AND TITLE FILES".
    DISPLAY (15, 10) "Hit any key to continue   ESC to ABORT".
    ACCEPT (LIN, COL) NOTHING WITH AUTO-SKIP.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01"
      DISPLAY(20, 10)" BUILD ABORTED "
      STOP RUN.
    OPEN OUTPUT TITLE-FILE.
    OPEN OUTPUT DEVICE-FILE.
    OPEN OUTPUT CONTROL-FILE.
STOP-RUN.
    DISPLAY(20, 10)" BUILD COMPLETED".
    CLOSE DEVICE-FILE.
    CLOSE CONTROL-FILE.
    CLOSE TITLE-FILE.
    EXIT PROGRAM.
STOPPED.
    STOP RUN.
```

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 IDENTIFICATION DIVISION.
 PROGRAM-ID.   MAITDEFT.
*-----------------------------------------------
*THIS IS THE DEFT DATA FILE MAINTENANCE PROGRAM
*-----------------------------------------------
  AUTHOR. Timothy OConnor.
 INSTALLATION. American Institutes for Research.
 DATE-WRITTEN.  AUG 1984.
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.
 OBJECT-COMPUTER.
 INPUT-OUTPUT SECTION.
 FILE-CONTROL.

       SELECT DEVICE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS DEVICE-KEY
            FILE STATUS IS DEVICE-STATUS-WORD.

      SELECT CONTROL-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS CONTROL-KEY
            FILE STATUS IS CTL-STATUS-WORD.

      SELECT TITLE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS TITLE-KEY
            FILE STATUS IS TITLE-STATUS-WORD.

 DATA DIVISION.
 FILE SECTION.
 FD  DEVICE-FILE
        LABEL RECORD IS STANDARD;
        VALUE OF FILE-ID IS "DEVICE".
 01  DEVICE-RECORD.
     05 DEVICE-KEY    PIC X(10).
     05 DEVICE-ANALYSIS OCCURS 20 TIMES PIC 999.
     05 DEVICE-TITLE    PIC X(60).

 FD  TITLE-FILE
         LABEL RECORD IS STANDARD;
         VALUE OF FILE-ID IS "TITLE".
 01  TITLE-RECORD.
     05 TITLE-KEY.
       07 TITLE-TYPE      PIC 9.
       07 TITLE-TASK      PIC X(9).
       07 TITLE-PERIOD    PIC X.
       07 TITLE-CONTROL   PIC X(9).
     05 TITLE-DESC        PIC X(60).

 FD  CONTROL-FILE
```

```
        LABEL RECORD IS STANDARD;
       VALUE OF FILE-ID IS "CONTROL".
01  CONTROL-RECORD.
    05 CONTROL-KEY    PIC X(20).
    05 CONTROL-ANALYSIS OCCURS 2 TIMES PIC 999.
    05 CORR-CTL-KEY   PIC X(20).

WORKING-STORAGE SECTION.
77  RATING PIC 999.
77  PREVIOUS-RATING PIC ZZ9.
77  EOF-DEVICE  PIC 9  VALUE 0.
77  TITLE-FLAG  PIC 9(4) COMP VALUE 0.
77  I    PIC 9(4) COMP.
01  REQ-TASK-NO.
    05 REQ-TYPE    PIC 9.
    05 REQ-TASK    PIC Z(4).
    05 FILLER  PIC X.
    05 REQ-SUBTASK    PIC X(4).
01  TASK-KEY.
    05 TYPE-PART  PIC X.
    05 TASK-PART  PIC X(9).
    05 PERIOD-PART PIC X VALUE ".".
    05 CONTROL-PART PIC X(9).
01  C-D-KEY  PIC X(10).
01  TASK-NO  PIC Z(3)9.9999 DISPLAY.
01  NOTHING PIC X.
01  CTL-STATUS-WORD    PIC XX.
01  READ-TASK-NO.
    05 READ-TYPE  PIC 9.
    05 READ-TASK1  PIC Z(4).
    05 FILLER  PIC X.
    05 READ-SUBTASK PIC X(4).
01  DEVICE-STATUS-WORD  PIC XX.
01  TITLE-STATUS-WORD  PIC XX.
01  NEW-DESC     PIC X(54).
01  OPTION      PIC X.
01  LAST-KEY      PIC XX.
01  Z       PIC 99.

PROCEDURE DIVISION.
BEGIN.
    OPEN I-O DEVICE-FILE.
    OPEN I-O CONTROL-FILE.
    OPEN I-O TITLE-FILE.
    DISPLAY (1, 1) ERASE.
    MOVE 0 TO TASK-NO.
    MOVE SPACES TO DEVICE-KEY.
DISPLAY-MENU.
    DISPLAY (1, 1) ERASE.
    DISPLAY (1, 12)
     "          Data Base Maintenance".
    DISPLAY (3, 12)
     "(1) Training Device - Task and Subtask Maintenance".
    DISPLAY (5, 12)
     "(2) Training Device - Control and Display Maintenance".
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     DISPLAY (7, 12)
      "(3) Operational Equipment - Task and Subtask Maintenance".
     DISPLAY (9, 12)
      "(4) Operational Equipment - Control and Display ",
               "Maintenance".
     DISPLAY (11, 12)
      "(5) Commonality Analysis"
     DISPLAY (13, 12)
      "(6) Similarity Matching"
     DISPLAY (15, 12)
      "(7) EXIT PROGRAM"
     DISPLAY (17, 30)
      "Enter Option  ".
     ACCEPT (LIN, COL) OPTION WITH AUTO-SKIP.
     DISPLAY (1, 1) ERASE.
     IF OPTION = "1" PERFORM DISPLAY-FUNCTION-KEYS
                     GO TO DEVICE-TITLES.
     IF OPTION = "2" PERFORM DISPLAY-FUNCTION-KEYS
                     GO TO CONTROL-TITLES.
     IF OPTION = "3" PERFORM DISPLAY-FUNCTION-KEYS
                     GO TO DEVICE-TITLES.
     IF OPTION = "4" PERFORM DISPLAY-FUNCTION-KEYS
                     GO TO CONTROL-TITLES.
     IF OPTION = "5" GO TO COMMONALITY-ANALYSIS.
     IF OPTION = "6" GO TO SIMILARITY-ANALYSIS.
     IF OPTION = "7" GO TO STOP-RUN.
     GO TO DISPLAY-MENU.
DEVICE-TITLES.
     IF OPTION = 1 MOVE 0 TO TYPE-PART.
     IF OPTION = 3 MOVE 1 TO TYPE-PART.
     MOVE "   0.0000" TO TASK-PART
     IF TYPE-PART = 0
      DISPLAY (3, 15)
      "(1) Training Device - Task and Subtask Definition      ".
     IF TYPE-PART = 1
       DISPLAY (3, 15)
      "(3) Operational Equipment - Task and Subtask Definition".
     MOVE TASK-KEY TO DEVICE-KEY.
     READ DEVICE-FILE RECORD INVALID KEY GO TO ADD-DEVICE.
     IF TYPE-PART = 0
      DISPLAY (6, 5)
                "Enter  Training Device  Task.Subtask number   ".
     IF TYPE-PART = 1
      DISPLAY (6, 5)
        "Enter  Operational Equipment Task.Subtask number   ".
     MOVE ZEROS TO TASK-NO.
     ACCEPT (LIN, COL) TASK-NO WITH AUTO-SKIP PROMPT.
     ACCEPT LAST-KEY FROM ESCAPE KEY.
     IF LAST-KEY = "01" GO TO DISPLAY-MENU.
     IF LAST-KEY = "02" OR LAST-KEY = "03" OR
        LAST-KEY = "04" OR LAST-KEY = "05"
       PERFORM DISPLAY-TASKS THRU DISPLAY-TASKS-END
       GO TO DEVICE-TITLES.
     MOVE TASK-NO TO TASK-PART.
     MOVE TASK-KEY TO DEVICE-KEY.
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    DISPLAY (4, 1) ERASE.
    DISPLAY (6, 5) "Task.Subtask = ", TASK-PART.
    DISPLAY (7, 5) "       Title = ".
    READ DEVICE-FILE RECORD
      INVALID KEY GO TO ADD-DEVICE.
    ACCEPT (LIN, COL) DEVICE-TITLE WITH UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO DISPLAY-MENU.
    IF DEVICE-TITLE = "DELETE" OR DEVICE-TITLE = "delete"
      GO TO DELETE-DEVICE.
    REWRITE DEVICE-RECORD INVALID KEY PERFORM BAD-KEY.
    DISPLAY (4, 1)ERASE.
    PERFORM DISPLAY-FUNCTION-KEYS.
    GO TO DEVICE-TITLES.
ADD-DEVICE.
    MOVE SPACES TO DEVICE-TITLE.
    IF DEVICE-KEY = "0   0.0000"
      DISPLAY (6, 5) "Enter Title of Training Device"
    ELSE
     IF DEVICE-KEY = "1   0.0000"
      DISPLAY (6, 5) "Enter Title of Operational Equipment ".
    DISPLAY (7, 5) "       Title = ".
    ACCEPT (LIN, COL) DEVICE-TITLE WITH UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO DISPLAY-MENU.
    IF DEVICE-TITLE = "DELETE" OR DEVICE-TITLE  = "delete"
      GO TO DISPLAY-MENU.
    PERFORM MOVE-NINES VARYING I FROM 1 BY 1 UNTIL I > 20.
    WRITE DEVICE-RECORD INVALID PERFORM BAD-KEY.
    DISPLAY (4, 1)ERASE.
    PERFORM DISPLAY-FUNCTION-KEYS.
    GO TO DEVICE-TITLES.
CONTROL-TITLES.
    IF OPTION = 2
      MOVE 0 TO TYPE-PART
      DISPLAY (3, 12)
      "(2) Training Device - Control and Display Mainten",
            "ance       ".
    IF OPTION = 4
      MOVE 1 TO TYPE-PART
      DISPLAY (3, 12)
      "(4) Operational Equipment - Control and Display ",
            "Maintenance".
    IF TYPE-PART = 0
     DISPLAY (6, 5)
       "Enter  Training Device  Task.Subtask number        ".
    IF TYPE-PART = 1
     DISPLAY (6, 5)
       "Enter  Operational Equipment Task.Subtask number   ".
    MOVE 0 TO TASK-NO.
    ACCEPT (LIN, COL) TASK-NO WITH AUTO-SKIP PROMPT.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO DISPLAY-MENU.
    IF LAST-KEY = "02" OR LAST-KEY = "03" OR
      LAST-KEY = "04" OR LAST-KEY = "05"
```

```
      PERFORM DISPLAY-TASKS THRU DISPLAY-TASKS-END
      GO TO CONTROL-TITLES.
    MOVE TASK-NO TO TASK-PART.
    MOVE TASK-KEY TO DEVICE-KEY.
    READ DEVICE-FILE RECORD INVALID KEY
        PERFORM BAD-KEY
        GO TO CONTROL-TITLES.
    DISPLAY (4, 1) ERASE.
    DISPLAY (6, 5) "Task.Subtask = ", TASK-PART.
    DISPLAY (7, 5) "       Title = ", DEVICE-TITLE.
GET-CONTROL-TITLE.
    DISPLAY (9, 1)ERASE.
    DISPLAY (9, 10)
              "Enter Control or Display number   ".
    MOVE "." TO PERIOD-PART.
    MOVE "          " TO CONTROL-PART.
    ACCEPT (LIN, COL) CONTROL-PART WITH UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY NOT = "00"
      DISPLAY (4, 1)ERASE
      GO TO CONTROL-TITLES.
    MOVE SPACES TO TITLE-DESC.
    MOVE TASK-KEY TO TITLE-KEY.
    DISPLAY (8, 1)ERASE.
    DISPLAY (9, 5) "Control/Display =", TASK-PART, ".",
        CONTROL-PART.
    DISPLAY (10, 5) "          Title = ".
    READ TITLE-FILE RECORD
      INVALID KEY GO TO ADD-CONTROL.
    ACCEPT (LIN, COL) TITLE-DESC WITH UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO DISPLAY-MENU.
    IF LAST-KEY NOT = "00"
      DISPLAY (4, 1)ERASE
      GO TO CONTROL-TITLES.
    IF TITLE-DESC = "DELETE" OR TITLE-DESC = "delete"
      GO TO DELETE-CONTROL.
    REWRITE TITLE-RECORD INVALID KEY PERFORM BAD-KEY.
    DISPLAY (4, 1)ERASE.
    PERFORM DISPLAY-FUNCTION-KEYS.
    GO TO GET-CONTROL-TITLE.
ADD-CONTROL.
    MOVE SPACES TO TITLE-DESC.
    ACCEPT (LIN, COL) TITLE-DESC WITH UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY NOT = "00" GO TO DISPLAY-MENU.
    IF TITLE-DESC = "DELETE" OR TITLE-KEY = "delete"
      GO TO DISPLAY-MENU.
    WRITE TITLE-RECORD INVALID KEY PERFORM BAD-KEY.
    GO TO GET-CONTROL-TITLE.
DELETE-DEVICE.
    DELETE DEVICE-FILE RECORD INVALID KEY PERFORM BAD-KEY.
    DISPLAY (4, 1)ERASE.
    PERFORM DISPLAY-FUNCTION-KEYS.
    GO TO DEVICE-TITLES.
```

```
DELETE-CONTROL.
    MOVE TITLE-KEY TO CONTROL-KEY.
    DELETE TITLE-FILE RECORD INVALID KEY PERFORM BAD-KEY.
    DELETE CONTROL-FILE RECORD INVALID KEY GO TO CONTROL-TITLES.
    DISPLAY (4, 1)ERASE.
    PERFORM DISPLAY-FUNCTION-KEYS.
    GO TO CONTROL-TITLES.
BAD-KEY.
    DISPLAY (4, 1)ERASE.
    DISPLAY (9, 8)"Task.Subtask = ", TASK-PART, " ",
      "NOT FOUND IN DATABASE".
    PERFORM TIMER.
    DISPLAY (4, 1) ERASE.
    PERFORM DISPLAY-FUNCTION-KEYS.
STOP-RUN.
    DISPLAY (1, 1)ERASE.
    CLOSE  CONTROL-FILE, DEVICE-FILE, TITLE-FILE.
    EXIT PROGRAM.
STOPPED.
    STOP RUN.
DISPLAY-TASKS.
    MOVE 0 TO TYPE-PART.
    IF LAST-KEY = "03" OR LAST-KEY = "05"
      MOVE 1 TO TYPE-PART.
    IF LAST-KEY = "04" OR LAST-KEY = "05"
      MOVE 1 TO TITLE-FLAG.
    MOVE TASK-NO TO TASK-PART.
    MOVE 0 TO Z.
    MOVE TASK-KEY TO DEVICE-KEY.
    MOVE DEVICE-KEY TO REQ-TASK-NO.
    READ DEVICE-FILE RECORD INVALID KEY
      GO TO DISPLAY-TASKS-END.
    IF LAST-KEY = "01" GO TO DISPLAY-TASKS-END.
 DISPLAY-TASKS-LOOP.
    MOVE 0 TO I.
    DISPLAY (8, 1)ERASE.
    DISPLAY (LIN, COL)"      ".
    GO TO DISPLAY-20-DEVICES.
DISPLAY-20-DEVICES.
    MOVE DEVICE-KEY TO READ-TASK-NO.
    MOVE DEVICE-KEY TO TASK-KEY.
    IF READ-TYPE NOT = REQ-TYPE GO TO DISPLAY-TASKS-END.
    ADD 1 TO I.
    IF I > 16
      DISPLAY(25, 50)"Hit any key to continue"
      ACCEPT(LIN, COL)NOTHING WITH AUTO-SKIP
      ACCEPT LAST-KEY FROM ESCAPE KEY
      MOVE 1 TO I
      IF LAST-KEY NOT = "01" DISPLAY(8, 1)ERASE.
    IF LAST-KEY = "01" GO TO DISPLAY-TASKS-END.
    IF  READ-SUBTASK NOT = "0000"
     DISPLAY (LIN, COL) "  ".
    DISPLAY TASK-PART, "  ", DEVICE-TITLE.
    IF TITLE-FLAG = 1
      PERFORM DISPLAY-CONTROLS THRU DISPLAY-CONTROLS-END.
```

```
    READ DEVICE-FILE NEXT RECORD
       AT END GO TO DISPLAY-TASKS-END.
    GO TO DISPLAY-20-DEVICES.
DISPLAY-TASKS-END.
    MOVE 0 TO TITLE-FLAG.
DISPLAY-CONTROLS.
    MOVE DEVICE-KEY TO TASK-KEY.
    MOVE SPACES TO CONTROL-PART.
    MOVE TASK-KEY TO TITLE-KEY.
    START TITLE-FILE KEY IS NOT LESS THAN TITLE-KEY
      INVALID KEY GO TO DISPLAY-CONTROLS-END.
    READ TITLE-FILE NEXT RECORD AT END
         GO TO DISPLAY-CONTROLS-END.
DISPLAY-20-CONTROLS.
    IF TITLE-TASK NOT = TASK-PART OR TITLE-TYPE NOT = TYPE-PART
        GO TO DISPLAY-CONTROLS-END.
    ADD 1 TO I.
    IF I > 16
      DISPLAY(25, 50)"Hit any key to continue"
      ACCEPT(LIN, COL)NOTHING WITH AUTO-SKIP
      ACCEPT LAST-KEY FROM ESCAPE KEY
      MOVE 1 TO I
      IF LAST-KEY NOT = "01" DISPLAY(8, 1)ERASE
      DISPLAY TASK-PART, "  ", DEVICE-TITLE.
    IF LAST-KEY = "01" GO TO DISPLAY-CONTROLS-END.
    DISPLAY "       ",  TITLE-CONTROL,
      " ", TITLE-DESC.
    READ TITLE-FILE NEXT RECORD AT END
         GO TO DISPLAY-CONTROLS-END.
    GO TO DISPLAY-20-CONTROLS.
DISPLAY-CONTROLS-END.
    EXIT.
TIMER.
    PERFORM NO-OP 5000 TIMES.
NO-OP.
    EXIT.
FIND-STARTING-TASK.
    MOVE 0 TO EOF-DEVICE.
    MOVE 1 TO TYPE-PART.
    MOVE ZEROS TO TASK-NO.
    DISPLAY (5, 1)
     "Enter Starting Operational Equipment Task.Subtask ",
        "number  ".
    ACCEPT (LIN, COL) TASK-NO WITH AUTO-SKIP PROMPT.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "02" OR LAST-KEY = "03" OR
      LAST-KEY = "04" OR LAST-KEY = "05"
      PERFORM DISPLAY-TASKS THRU DISPLAY-TASKS-END
      GO TO FIND-STARTING-TASK.
    MOVE TASK-NO TO TASK-PART.
    MOVE TASK-KEY TO REQ-TASK-NO.
    MOVE TASK-KEY TO DEVICE-KEY.
    START DEVICE-FILE KEY IS EQUAL TO DEVICE-KEY
                INVALID KEY
                    DISPLAY (LIN, 1) ERASE
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```
                    DISPLAY (LIN, 1)
                    "TASK.SUBTASK NOT FOUND IN DATA BASE "
                    PERFORM TIMER
                    GO TO FIND-STARTING-TASK.
READ-TASK.
    MOVE 0 TO EOF-DEVICE.
    READ DEVICE-FILE NEXT RECORD AT END MOVE 1 TO EOF-DEVICE
          GO TO READ-TASK-EXIT.
    MOVE DEVICE-KEY TO READ-TASK-NO.
    MOVE DEVICE-KEY TO TASK-KEY.
    IF TASK-PART = "   0.0000" GO TO READ-TASK.
    IF REQ-SUBTASK = "0000" AND READ-SUBTASK NOT = "0000"
      GO TO READ-TASK.
    IF REQ-SUBTASK NOT = "0000" AND READ-SUBTASK = "0000"
      GO TO READ-TASK.
    IF REQ-TYPE NOT = READ-TYPE GO TO READ-TASK.
READ-TASK-EXIT.
    EXIT.
RATE-TASKS.
    PERFORM READ-TASK THRU READ-TASK-EXIT.
    IF EOF-DEVICE = 1 GO TO RATE-TASKS-EXIT.
    PERFORM RATE-EACH-TASK THRU RATE-EACH-TASK-EXIT
    IF LAST-KEY = "01" GO TO RATE-TASKS-EXIT.
RATE-TASKS-EXIT.
    EXIT.
RATE-EACH-TASK.
    DISPLAY (23 , 1)ERASE.
    DISPLAY (LIN, 1) "Task.Subtask = ", TASK-PART, " ",
                DEVICE-TITLE
    MOVE DEVICE-ANALYSIS(5) TO RATING.
    IF RATING NOT = 999
      MOVE RATING TO PREVIOUS-RATING
      DISPLAY (LIN, 1) "Previous Rating = ", PREVIOUS-RATING.
    DISPLAY (LIN, COL) "    Enter Rating = "
    ACCEPT (LIN, COL) RATING WITH AUTO-SKIP UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY = "01" GO TO RATE-EACH-TASK-EXIT.
    IF RATING = PREVIOUS-RATING GO TO RATE-EACH-TASK-EXIT.
    MOVE RATING TO DEVICE-ANALYSIS(5)
    REWRITE DEVICE-RECORD INVALID KEY PERFORM BAD-KEY.
RATE-EACH-TASK-EXIT.
    EXIT.
COMMONALITY-ANALYSIS.
    DISPLAY (1, 1)ERASE.
    DISPLAY (3, 30)
        "(5) Commonality Analysis".
    PERFORM DISPLAY-FUNCTION-KEYS.
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO DISPLAY-MENU.
    DISPLAY (4, 1)ERASE.
    DISPLAY " ".
    DISPLAY "     ",
     "Consider descriptions of the subtasks (tasks) that ",
     "comprise the".
    DISPLAY "     ",
```

```
      "training objective(s), the subtasks (tasks) that ",
      "comprise the".
     DISPLAY "     ",
      "operational performance objective(s), as well as ",
      "descriptions of the".
     DISPLAY "     ",
      "training device and operational equipment, including ",
      "their displays".
     DISPLAY "     and controls.".
     DISPLAY "     ",
     DISPLAY "     ",
      "For each subtask (task) in the operational performance ",
      "objective(s),".
     DISPLAY "     ",
      "enter a '1' if it is represented (simulated) in the ",
      "training".
     DISPLAY "     ",
      "objective(s); enter a '0' if it is not represented ",
      "(simulated) in the ".
     DISPLAY "     ",
      "training objective(s)."
     PERFORM RATE-TASKS THRU RATE-TASKS-EXIT VARYING I
       FROM 1 BY 1 UNTIL EOF-DEVICE = 1 OR LAST-KEY = "01".
     GO TO DISPLAY-MENU.
SIMILARITY-ANALYSIS.
     DISPLAY (1, 1)ERASE.
     DISPLAY (3, 15)
      "(6) Similarity Matching".
     PERFORM DISPLAY-FUNCTION-KEYS.
GET-OE-TASK-NO.
     MOVE 1 TO TYPE-PART.
     DISPLAY (6, 5)
        "Enter  Operational Equipment Task.Subtask number   ".
     MOVE 0 TO TASK-NO.
     ACCEPT (LIN, COL) TASK-NO WITH AUTO-SKIP PROMPT.
     ACCEPT LAST-KEY FROM ESCAPE KEY.
     IF LAST-KEY = "01" GO TO DISPLAY-MENU.
     IF LAST-KEY = "02" OR LAST-KEY = "03" OR
       LAST-KEY = "04" OR LAST-KEY = "05"
       PERFORM DISPLAY-TASKS THRU DISPLAY-TASKS-END
       GO TO GET-OE-TASK-NO.
     MOVE 1 TO TYPE-PART.
     MOVE TASK-NO TO TASK-PART.
     MOVE TASK-KEY TO DEVICE-KEY.
     MOVE DEVICE-KEY TO REQ-TASK-NO.
     READ DEVICE-FILE RECORD INVALID KEY
         PERFORM BAD-KEY
         GO TO SIMILARITY-ANALYSIS.
     DISPLAY (4, 1) ERASE.
     DISPLAY (5, 1)"Operational Equipment".
     DISPLAY (6, 5) "Task.Subtask = ", TASK-PART.
     DISPLAY (7, 5) "       Title = ", DEVICE-TITLE.
     IF DEVICE-ANALYSIS(5) NOT = 1
       DISPLAY (9, 1) "IS NOT COMMON IN TRAINING DEVICE"
       PERFORM TIMER
```

```
      GO TO SIMILARITY-ANALYSIS.
GET-SIM-CONTROL-TITLE.
    MOVE 1 TO TYPE-PART.
    MOVE REQ-TASK-NO TO TASK-KEY.
    DISPLAY (8, 1)ERASE.
    DISPLAY (9, 10)
              "Enter Control or Display number   ".
    MOVE "." TO PERIOD-PART.
    MOVE "           " TO CONTROL-PART.
    ACCEPT (LIN, COL) CONTROL-PART WITH UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY NOT = "00"
      GO TO SIMILARITY-ANALYSIS.
    MOVE TASK-KEY TO TITLE-KEY.
    READ TITLE-FILE RECORD INVALID KEY
      DISPLAY(8, 1)ERASE
      DISPLAY (8, 1) TASK-PART, ".", CONTROL-PART,
        "NOT FOUND IN DATABASE"
      PERFORM TIMER
      GO TO GET-SIM-CONTROL-TITLE.
    DISPLAY (8, 1)ERASE.
    DISPLAY (9, 5) "Control/Display =", TASK-PART, ".",
       CONTROL-PART.
    DISPLAY (10, 5) "          Title = ", TITLE-DESC.
    MOVE TITLE-KEY TO CONTROL-KEY.
GET-CORR-TASK-NO.
    DISPLAY (14, 5)ERASE.
    DISPLAY (16, 5)
       "Enter  Training Device Task.Subtask number   ".
    MOVE 0 TO TASK-NO.
    ACCEPT (LIN, COL) TASK-NO WITH AUTO-SKIP PROMPT.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY NOT = "00" GO TO GET-SIM-CONTROL-TITLE.
    MOVE 0 TO TYPE-PART.
    MOVE TASK-NO TO TASK-PART.
    MOVE TASK-KEY TO DEVICE-KEY.
    READ DEVICE-FILE RECORD INVALID KEY
      DISPLAY(14, 1)ERASE
      DISPLAY (14, 1) TASK-PART, " ",
        "NOT FOUND IN DATABASE"
      PERFORM TIMER
        GO TO GET-CORR-TASK-NO.
    DISPLAY (14, 1) ERASE.
    DISPLAY (15, 1)"Training Device".
    DISPLAY (16, 5) "Task.Subtask = ", TASK-PART.
    DISPLAY (17, 5) "       Title = ", DEVICE-TITLE.
GET-CORR-CONTROL-TITLE.
    DISPLAY (18, 1)ERASE.
    DISPLAY (19, 10)
              "Enter Control or Display number   ".
    MOVE "." TO PERIOD-PART.
    MOVE "           " TO CONTROL-PART.
    ACCEPT (LIN, COL) CONTROL-PART WITH UPDATE.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    IF LAST-KEY NOT = "00"
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      GO TO GET-CORR-TASK-NO.
    MOVE TASK-KEY TO TITLE-KEY.
    READ TITLE-FILE RECORD INVALID KEY
      DISPLAY(18, 1)ERASE
      DISPLAY (18, 1) TASK-PART, ".", CONTROL-PART,
        "NOT FOUND IN DATABASE"
      PERFORM TIMER
      GO TO GET-SIM-CONTROL-TITLE.
    DISPLAY (18, 1)ERASE.
    DISPLAY (19, 5) "Control/Display =", TASK-PART, ".",
       CONTROL-PART.
    DISPLAY (20, 5) "          Title = ", TITLE-DESC.
    MOVE TITLE-KEY TO CORR-CTL-KEY.
    DISPLAY(25, 50)"Hit any key to continue"
    ACCEPT(LIN, COL)NOTHING WITH AUTO-SKIP
    ACCEPT LAST-KEY FROM ESCAPE KEY
    IF LAST-KEY NOT = "00" GO TO SIMILARITY-ANALYSIS.
    MOVE 999 TO CONTROL-ANALYSIS(1).
    MOVE 999 TO CONTROL-ANALYSIS(2).
    WRITE CONTROL-RECORD INVALID KEY GO TO REWRITE-CONTROL-REC.
    GO TO GET-CORR-TASK-NO.
REWRITE-CONTROL-REC.
    REWRITE CONTROL-RECORD INVALID KEY
      DISPLAY (1, 1)ERASE
      DISPLAY "INVALID KEY ON CONTROL REWRITE ", CONTROL-KEY.
    GO TO GET-CORR-TASK-NO.
MOVE-NINES.
    MOVE 999 TO DEVICE-ANALYSIS(I).
DISPLAY-FUNCTION-KEYS.
    DISPLAY (21, 1)ERASE.
    DISPLAY (22, 5)
     "Hit 'F1' to List Training Device Tasks & Subtasks".
    DISPLAY (23, 5)
     "Hit 'F2' to List Operational Equipment Tasks & Subtasks".
    DISPLAY (24, 5)
     "Hit 'F3' to List Training Device Controls & Displays".
    DISPLAY (25, 5)
     "Hit 'F4' to List Operational Equipment ",
           "Controls & Displays".
```

```
 IDENTIFICATION DIVISION.
 PROGRAM-ID.   LISTDEFT.
*-----------------------------------------------
*THIS IS THE DEFT DATA FILE LISTING PROGRAM
*-----------------------------------------------
 AUTHOR. Timothy OConnor.
 INSTALLATION. American Institutes for Research.
 DATE-WRITTEN.  OCT 1984.
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.
 OBJECT-COMPUTER.
 INPUT-OUTPUT SECTION.
 FILE-CONTROL.

       SELECT DEVICE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS DEVICE-KEY
            FILE STATUS IS DEVICE-STATUS-WORD.

      SELECT TITLE-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS TITLE-KEY
            FILE STATUS IS TITLE-STATUS-WORD.


      SELECT CONTROL-FILE ASSIGN TO DISK
            ORGANIZATION IS INDEXED
            ACCESS MODE IS DYNAMIC
            RECORD KEY IS CONTROL-KEY
            FILE STATUS IS CTL-STATUS-WORD.

 DATA DIVISION.
 FILE SECTION.
 FD  DEVICE-FILE
       LABEL RECORD IS STANDARD;
       VALUE OF FILE-ID IS "DEVICE".
 01  DEVICE-RECORD.
     05 DEVICE-KEY   PIC X(10).
     05 DEVICE-ANALYSIS OCCURS 20 TIMES PIC 999.
     05 DEVICE-TITLE   PIC X(60).

 FD  TITLE-FILE
        LABEL RECORD IS STANDARD;
        VALUE OF FILE-ID IS "TITLE".
 01  TITLE-RECORD.
     05 TITLE-KEY.
       07 TITLE-TYPE     PIC 9.
       07 TITLE-TASK     PIC X(9).
       07 TITLE-PERIOD   PIC X.
       07 TITLE-CONTROL  PIC X(9).
     05 TITLE-DESC       PIC X(60).
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FD  CONTROL-FILE
        LABEL RECORD IS STANDARD;
       VALUE OF FILE-ID IS "CONTROL".
01  CONTROL-RECORD.
    05 CONTROL-KEY    PIC X(20).
    05 CONTROL-ANALYSIS OCCURS 2 TIMES PIC 999.
    05 CORR-CTL-KEY   PIC X(20).
WORKING-STORAGE SECTION.
01  ANSWER PIC X.
01  NOTHING PIC X.
01  TITLE-FLAG  PIC S9(4) COMP VALUE 0.
01  TASK-NO  PIC Z(3)9.9999 DISPLAY.
01  CTL-STATUS-WORD    PIC XX.
01  RATING PIC 999.
01  PREVIOUS-RATING PIC ZZ9.
01  TITLE-STATUS-WORD  PIC XX.
01  DEVICE-STATUS-WORD  PIC XX.
01  EOF-DEVICE  PIC 9  VALUE 0.
01  REQ-TASK-NO.
    05 REQ-TYPE  PIC 9.
    05 REQ-TASK    PIC Z(4).
    05 FILLER  PIC X.
    05 REQ-SUBTASK    PIC X(4).
01  READ-TASK-NO.
    05 READ-TYPE  PIC 9.
    05 READ-TASK1  PIC Z(4).
    05 FILLER  PIC X.
    05 READ-SUBTASK PIC X(4).
01  TASK-KEY.
    05 TYPE-PART  PIC X.
    05 TASK-PART  PIC X(9).
    05 PERIOD-PART PIC X VALUE ".".
    05 CONTROL-PART PIC X(9).
01  OPTION      PIC 9.
01  PREV-OPTION      PIC 9.
01  LAST-KEY    PIC XX.
01  X    PIC 9(4).
01  Q    PIC 9(4).
01  Z    PIC 9(4).
01  K    PIC 9(4).
01  I    PIC 9(4).

PROCEDURE DIVISION.
BEGIN.
    OPEN I-O DEVICE-FILE.
    OPEN INPUT CONTROL-FILE.
    OPEN INPUT TITLE-FILE.
    DISPLAY (1, 1) ERASE.
    MOVE ZEROS TO TASK-NO.
    MOVE TASK-NO TO REQ-TASK-NO.
    MOVE 0 TO OPTION.
MENU.
    MOVE OPTION TO PREV-OPTION.
    MOVE 0 TO OPTION.
    MOVE 0 TO EOF-DEVICE.
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    MOVE "00" TO LAST-KEY
    DISPLAY (1, 1)ERASE.
    DISPLAY (1, 25)
              "           LIST RATINGS          ".
    DISPLAY (4, 25)
              "(1)  List Training Device Ratings      ".
    DISPLAY (6, 25)
              "(2)  List Operational Equipment Ratings".
    DISPLAY (8, 25)
              "(3)  List Common Controls & Displays".
    DISPLAY (10, 25)
              "(4)  EXIT PROGRAM".
    DISPLAY (13, 12)"Enter Option Number ".
    ACCEPT (LIN, COL) OPTION WITH AUTO-SKIP.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    DISPLAY (1, 1)ERASE.
    IF OPTION = 1 GO TO TASK-LIST-LOOP.
    IF OPTION = 2 GO TO TASK-LIST-LOOP.
    IF OPTION = 3 GO TO CONTROL-LIST-LOOP.
    IF OPTION = 4 GO TO STOP-RUN.
    GO TO MENU.
TASK-LIST-LOOP.
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    PERFORM READ-TASK THRU READ-TASK-EXIT.
    GO TO MENU.
CONTROL-LIST-LOOP.
    PERFORM FIND-STARTING-TASK.
    IF LAST-KEY = "01" GO TO MENU.
    MOVE TASK-KEY TO CONTROL-KEY.
    START CONTROL-FILE KEY IS NOT LESS THAN CONTROL-KEY
              INVALID KEY
                  DISPLAY (LIN, 1) ERASE
                  DISPLAY (LIN, 1)
                  "TASK.SUBTASK NOT FOUND IN DATA BASE "
                  PERFORM TIMER
                  GO TO CONTROL-LIST-LOOP.
    DISPLAY (1, 1)ERASE.
    PERFORM READ-CONTROL THRU READ-CONTROL-EXIT.
    GO TO MENU.
HIT-ANY-KEY.
    DISPLAY (25, 50) "Hit any key to continue ".
    ACCEPT (LIN, COL) NOTHING WITH AUTO-SKIP.
    ACCEPT LAST-KEY FROM ESCAPE KEY.
    DISPLAY(1, 1)ERASE.
FIND-STARTING-TASK.
    DISPLAY (5, 1)ERASE.
    MOVE ZEROS TO TASK-NO.
    DISPLAY (22, 5)
     "Hit 'F1' to List Training Device Tasks & Subtasks".
    DISPLAY (23, 5)
     "Hit 'F2' to List Operational Equipment Tasks & Subtasks".
    DISPLAY (24, 5)
     "Hit 'F3' to List Training Device Controls & Displays".
    DISPLAY (25, 5)
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      "Hit 'F4' to List Operational Equipment ",
             "Controls & Displays".
     IF OPTION = 1
      MOVE 0 TO TYPE-PART
      DISPLAY (5, 1)
      "Enter Starting Training Device Task.Subtask number  "
     ELSE
          MOVE 1 TO TYPE-PART
          DISPLAY (5, 1)
          "Enter Starting Operational Equipment Task.Subtask ",
          "number  ".
     ACCEPT (LIN, COL) TASK-NO WITH AUTO-SKIP PROMPT.
     ACCEPT LAST-KEY FROM ESCAPE KEY.
     MOVE TASK-NO TO TASK-PART.
     IF LAST-KEY = "02" OR LAST-KEY = "03" OR
        LAST-KEY = "04" OR LAST-KEY = "05"
       PERFORM DISPLAY-TASKS THRU DISPLAY-TASKS-END
       GO TO FIND-STARTING-TASK.
     IF LAST-KEY NOT = "01"
      MOVE TASK-NO TO TASK-PART
      MOVE TASK-KEY TO REQ-TASK-NO
      MOVE TASK-KEY TO DEVICE-KEY
      START DEVICE-FILE KEY IS EQUAL TO DEVICE-KEY
                INVALID KEY
                    DISPLAY (LIN, 1) ERASE
                    DISPLAY (LIN, 1)
                    "TASK.SUBTASK NOT FOUND IN DATA BASE "
                    PERFORM TIMER
                    GO TO FIND-STARTING-TASK.
     DISPLAY (1, 1)ERASE.
READ-TASK.
     MOVE 0 TO EOF-DEVICE.
     READ DEVICE-FILE NEXT RECORD AT END MOVE 1 TO EOF-DEVICE
           GO TO READ-TASK-EXIT.
     MOVE DEVICE-KEY TO READ-TASK-NO.
     MOVE DEVICE-KEY TO TASK-KEY.
     IF DEVICE-KEY = "1   0.0000" GO TO READ-TASK.
     DISPLAY (1, 1)ERASE.
     IF TYPE-PART = "0" DISPLAY (1, 32)
         "Training Device ".
     IF TYPE-PART = "1" DISPLAY (1, 32)
         "Operational Equipment".
     DISPLAY (3, 1)ERASE.
     DISPLAY "    ", TASK-PART, "    ", DEVICE-TITLE.
     DISPLAY " ".
DISPLAY-DEFT1.
     IF DEVICE-KEY NOT = "0   0.0000" GO TO DISPLAY-DEFT-TD.
     DISPLAY " ".
     DISPLAY " ".
     DISPLAY "                              ",
             "DEFT I - Device Level Ratings".
     DISPLAY " ".
     DISPLAY " PERFORM   LEARNING  TRAINING  RESIDUAL ",
             " RESIDUAL  PHYSICAL  FUNCTION  TRAINING".
     DISPLAY " DEFICIT     DIFF      ACQ     DEFICIT  ",
```

```
            "LEARN DIFF SIMILAR   SIMILAR   TRANSFER".
    DISPLAY "   ", DEVICE-ANALYSIS(1), "    ",
            "   ", DEVICE-ANALYSIS(2), "    ",
            "   ", DEVICE-ANALYSIS(3), "    ",
            "   ", DEVICE-ANALYSIS(4), "    ",
            "   ", DEVICE-ANALYSIS(5), "    ",
            "   ", DEVICE-ANALYSIS(6), "    ",
            "   ", DEVICE-ANALYSIS(7), "    ",
            "   ", DEVICE-ANALYSIS(8).
    DISPLAY " ".
    DISPLAY " ".
    DISPLAY "   ------------------------------------",
            "------------------------------------".
    DISPLAY " ".
    DISPLAY "                                ",
            "DEFT II - Device Level Ratings".
    DISPLAY " ".
    DISPLAY "       TRAINING ACQUISITION              ",
            "         TRAINING TRANSFER             ".
    DISPLAY "     (1)     (2)     (3)     (4)         ",
            "        (1)       (2)       (3)         ".
    DISPLAY "     ", DEVICE-ANALYSIS(9),
            "     ", DEVICE-ANALYSIS(10),
            "     ", DEVICE-ANALYSIS(11),
            "     ", DEVICE-ANALYSIS(12), "         ",
            "        ", DEVICE-ANALYSIS(13),
            "       ", DEVICE-ANALYSIS(14),
            "       ", DEVICE-ANALYSIS(15).
    PERFORM HIT-ANY-KEY.
    IF LAST-KEY = "01" GO TO READ-TASK-EXIT.
    GO TO READ-TASK.
DISPLAY-DEFT-TD.
    IF TYPE-PART = "1" GO TO DISPLAY-DEFT-OE.
    DISPLAY "                  ",
      "DEFT II - Training Device Task(Subtask) Ratings".
    DISPLAY " ".
    DISPLAY "       PERFORMANCE DEFICIT               ",
            "       LEARNING DIFFICULTY             ".
    DISPLAY "              ", DEVICE-ANALYSIS(1),
            "                    ",
            "              ", DEVICE-ANALYSIS(2),

    DISPLAY " ".
    DISPLAY "   ------------------------------------",
            "------------------------------------".
    DISPLAY " ".
    DISPLAY "                ",
      "DEFT III - Training Device Task(Subtask) Ratings".
    DISPLAY " ".
    DISPLAY "       PERFORMANCE DEFICIT               ",
            "         LEARNING DIFFICULTY             ".
    DISPLAY "                                         ",
            "   (1)   (2)   (3)   (4)   (5)   (6)   ".
    DISPLAY "                ", DEVICE-ANALYSIS(3),
            "                    ",
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            "    ", DEVICE-ANALYSIS(4),
            "    ", DEVICE-ANALYSIS(5),
            "    ", DEVICE-ANALYSIS(6),
            "    ", DEVICE-ANALYSIS(7),
            "    ", DEVICE-ANALYSIS(8),
            "    ", DEVICE-ANALYSIS(9).
    DISPLAY " ".
    DISPLAY "                                    TRAINING ",
            "ACQUISITION                                 ".
    DISPLAY "    (1)    (2)    (3)    (4)    (5)    (",
            "6)    (7)    (8)    (9)    (10)   (11) ".
    DISPLAY "    ", DEVICE-ANALYSIS(10),
            "    ", DEVICE-ANALYSIS(11),
            "    ", DEVICE-ANALYSIS(12),
            "    ", DEVICE-ANALYSIS(13),
            "    ", DEVICE-ANALYSIS(14),
            "    ", DEVICE-ANALYSIS(15),
            "    ", DEVICE-ANALYSIS(16),
            "    ", DEVICE-ANALYSIS(17),
            "    ", DEVICE-ANALYSIS(18),
            "    ", DEVICE-ANALYSIS(19),
            "    ", DEVICE-ANALYSIS(20).
    PERFORM HIT-ANY-KEY.
    IF LAST-KEY = "01" GO TO READ-TASK-EXIT.
    GO TO READ-TASK.
DISPLAY-DEFT-OE.
    DISPLAY "                ",
      "DEFT II - Operational Equipment Task(Subtask) Ratings".
    DISPLAY " ".
    DISPLAY "          RESIDUAL DEFICIT                ",
            "     RESIDUAL LEARNING DIFFICULTY       ".
    DISPLAY "                ", DEVICE-ANALYSIS(1),
            "                   ",
            "                  ", DEVICE-ANALYSIS(2).
    DISPLAY " ".
    DISPLAY "         PHYSICAL SIMILARITY             ",
            "       FUNCTIONAL SIMILARITY            ".
    DISPLAY "                ", DEVICE-ANALYSIS(3),
            "                   ",
            "                ", DEVICE-ANALYSIS(4).
    DISPLAY " ".
    DISPLAY "   ------------------------------------",
            "-------------------------------------".
    DISPLAY " ".
    DISPLAY "                ",
      "DEFT III - Operational Equipment Task(Subtask) Ratings".
    DISPLAY " ".
    DISPLAY "             COMMONALITY                ",
            "        RESIDUAL DEFICIT               ".
    DISPLAY "                ", DEVICE-ANALYSIS(5),
            "                   ",
            "                ", DEVICE-ANALYSIS(6).
    DISPLAY " ".
    DISPLAY "     RESIDUAL LEARNING DIFFICULTY       ",
            "          TRAINING TRANSFER            ".
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    DISPLAY "  (1)   (2)   (3)   (4)   (5)   (6)     ",
            "(1)  (2)  (3)  (4)  (5)  (6)  (7)  (8) ".
    DISPLAY "  ", DEVICE-ANALYSIS(7),
            "   ", DEVICE-ANALYSIS(8),
            "   ", DEVICE-ANALYSIS(9),
            "   ", DEVICE-ANALYSIS(10),
            "   ", DEVICE-ANALYSIS(11),
            "   ", DEVICE-ANALYSIS(12),
            "     ", DEVICE-ANALYSIS(13),
            "  ", DEVICE-ANALYSIS(14),
            "  ", DEVICE-ANALYSIS(15),
            "  ", DEVICE-ANALYSIS(16),
            "  ", DEVICE-ANALYSIS(17),
            "  ", DEVICE-ANALYSIS(18),
            "  ", DEVICE-ANALYSIS(19),
            "  ", DEVICE-ANALYSIS(20).
    PERFORM HIT-ANY-KEY.
    IF LAST-KEY = "01" GO TO READ-TASK-EXIT.
    GO TO READ-TASK.
READ-TASK-EXIT.
    EXIT.
READ-CONTROL.
    READ CONTROL-FILE NEXT RECORD AT END
        GO TO READ-CONTROL-EXIT.
    MOVE CONTROL-KEY TO TITLE-KEY.
    MOVE CONTROL-KEY TO DEVICE-KEY.
    READ DEVICE-FILE RECORD INVALID KEY GO TO READ-CONTROL.
    READ TITLE-FILE RECORD INVALID KEY GO TO READ-CONTROL.
    MOVE DEVICE-KEY TO TASK-KEY.
    IF DEVICE-ANALYSIS(5) NOT = 1 GO TO READ-CONTROL.
    DISPLAY (1, 1)ERASE.
    IF TYPE-PART = "1" DISPLAY (1, 32)
        "Operational Equipment".
    DISPLAY (3, 1)ERASE.
    DISPLAY "    ", TASK-PART, "    ", DEVICE-TITLE.
    DISPLAY " ".
    DISPLAY "      ", TITLE-CONTROL, "    ", TITLE-DESC.
    MOVE CORR-CTL-KEY TO DEVICE-KEY.
    MOVE CORR-CTL-KEY TO TITLE-KEY.
    READ DEVICE-FILE RECORD INVALID KEY GO TO READ-CONTROL.
    READ TITLE-FILE RECORD INVALID KEY GO TO READ-CONTROL.
    MOVE DEVICE-KEY TO TASK-KEY.
    IF TYPE-PART = "0" DISPLAY (7, 32)
        "Training Device".
    DISPLAY (9, 1)ERASE.
    DISPLAY "    ", TASK-PART, "    ", DEVICE-TITLE.
    DISPLAY " ".
    DISPLAY "      ", TITLE-CONTROL, "    ", TITLE-DESC.
    DISPLAY " ".
    DISPLAY "        ----------------------------------------".
    DISPLAY " ".
    DISPLAY "          PHYSICAL SIMILARITY           ",
            "       FUNCTIONAL SIMILARITY          ".
    DISPLAY "                  ", CONTROL-ANALYSIS(1),
            "                    ",
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            "                    ", CONTROL-ANALYSIS(2).
    DISPLAY " ".
    PERFORM HIT-ANY-KEY.
    IF LAST-KEY = "01" GO TO READ-CONTROL-EXIT.
    GO TO READ-CONTROL.
READ-CONTROL-EXIT.
    EXIT.
STOP-RUN.
    DISPLAY(1, 1)ERASE.
    CLOSE DEVICE-FILE.
    CLOSE CONTROL-FILE.
    CLOSE TITLE-FILE.
    EXIT PROGRAM.
STOPPED.
    STOP RUN.
TIMER.
    PERFORM NO-OP 2000 TIMES.
NO-OP.
    EXIT.
DISPLAY-TASKS.
    MOVE 0 TO TYPE-PART.
    IF LAST-KEY = "03" OR LAST-KEY = "05"
      MOVE 1 TO TYPE-PART.
    IF LAST-KEY = "04" OR LAST-KEY = "05"
      MOVE 1 TO TITLE-FLAG.
    MOVE 0 TO Q.
    MOVE TASK-KEY TO DEVICE-KEY.
    MOVE DEVICE-KEY TO REQ-TASK-NO.
    READ DEVICE-FILE RECORD INVALID KEY
      GO TO DISPLAY-TASKS-END.
    IF LAST-KEY = "01" GO TO DISPLAY-TASKS-END.
DISPLAY-TASKS-LOOP.
    MOVE 0 TO I.
    DISPLAY (5, 1)ERASE.
    DISPLAY (LIN, COL)"          ".
    GO TO DISPLAY-20-DEVICES.
DISPLAY-20-DEVICES.
    MOVE DEVICE-KEY TO READ-TASK-NO.
    MOVE DEVICE-KEY TO TASK-KEY.
    IF READ-TYPE NOT = REQ-TYPE MOVE 1 TO Q.
    ADD 1 TO I.
    IF I > 16 OR Q = 1
      DISPLAY(25, 7)"Hit any key to continue"
      ACCEPT(LIN, COL)NOTHING WITH AUTO-SKIP
      ACCEPT LAST-KEY FROM ESCAPE KEY
      DISPLAY(6, 1)ERASE
      MOVE 1 TO I
      IF Q = 1 GO TO DISPLAY-TASKS-END.
    IF LAST-KEY = "01" GO TO DISPLAY-TASKS-END.
    IF  READ-SUBTASK NOT = "0000"
     DISPLAY (LIN, COL) "  ".
    DISPLAY TASK-PART, "  ", DEVICE-TITLE.
    IF TITLE-FLAG = 1
      PERFORM DISPLAY-CONTROLS THRU DISPLAY-CONTROLS-END.
    READ DEVICE-FILE NEXT RECORD AT END MOVE 1 TO Q.
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    GO TO DISPLAY-20-DEVICES.
DISPLAY-TASKS-END.
    MOVE 0 TO TITLE-FLAG.
    DISPLAY(6, 1)ERASE.
DISPLAY-CONTROLS.
    MOVE DEVICE-KEY TO TASK-KEY.
    MOVE SPACES TO CONTROL-PART.
    MOVE TASK-KEY TO TITLE-KEY.
    START TITLE-FILE KEY IS NOT LESS THAN TITLE-KEY
      INVALID KEY GO TO DISPLAY-CONTROLS-END.
    READ TITLE-FILE NEXT RECORD AT END
         GO TO DISPLAY-CONTROLS-END.
DISPLAY-20-CONTROLS.
    IF TITLE-TASK NOT = TASK-PART OR TITLE-TYPE NOT = TYPE-PART
        GO TO DISPLAY-CONTROLS-END.
    ADD 1 TO I.
    IF I > 16
      DISPLAY(25, 7)"Hit any key to continue"
      ACCEPT(LIN, COL)NOTHING WITH AUTO-SKIP
      ACCEPT LAST-KEY FROM ESCAPE KEY
      DISPLAY(6, 1)ERASE
      DISPLAY TASK-PART, "  ", DEVICE-TITLE
      MOVE 1 TO I.
    IF LAST-KEY = "01" GO TO DISPLAY-CONTROLS-END.
    DISPLAY "       ",  TITLE-CONTROL,
      " ", TITLE-DESC.
    READ TITLE-FILE NEXT RECORD AT END
         GO TO DISPLAY-CONTROLS-END.
    GO TO DISPLAY-20-CONTROLS.
DISPLAY-CONTROLS-END.
    EXIT.
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